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Y20-0358-0

SALES and SYSTEMS GUIDE

THE TIME AUTOMATED GRID SYSTEM (TAG)

The Time Automated Grid System (TAG) is a study technique utilizing a series of IBM restricted programs developed by the New York Field Systems Center. The programs have been distributed to a number of other Field Systems Centers and in some instances their personnel have been trained in the use of TAG. The manual on TAG is not to be distributed to customers until the requirements for distribution as outlined in the foreword of the manual are met.

TAG is used in systems design. When the proper data regarding the output of an application area is provided to TAG on the Tag Input/Output Analysis Form (X20-1779), the system will provide information as to what inputs are necessary and at what point in time. TAG is able to define a minimum data base for any system. With the aid of the reports generated by TAG, the user can systematically resolve the question of how the required inputs are to be entered into the data flow. When both the inputs and outputs have been defined to TAG, the next iteration of the program produces file format and systems flow descriptions. The user obtains an overview of his system, showing the interrelationship of all data in the system. The information provided by TAG allows the analyst to do a more thorough, knowledgeable job of systems design. The input/output of a sample problem is included.

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Approved For Release 2008/06/05 : CIA-RDP73T00325R000100040003-6

The Time Automated Grid system (TAG) is a study technique utilizing a series of IBM restricted programs developed by the New York Field Systems Center. The programs have been distributed to a number of other Field Systems Centers and in some instances their personnel have been trained in the use of TAG.

It is necessary that any IBM branch office whose customers desire to use TAG contact the local Field Systems Center to determine the availability of the required one-day class for customers on TAG and the willingness of the center to process the customers' data using the TAG programs. This manual should not be provided to customers until the branch office has fulfilled this requirement.

Contents

Progress has been the keynote in data processing since the introduction of the computer: improvements in hardware design have resulted in equipment capable of performing hundreds or even thousands of instructions in a single second; software packages have been created that allow the computer to monitor its own operation; complex activities in all industries have been brought under the computer's control. The trend has been, and still is, toward increased speed and sophistication of equipment and broader scope of use. Real-time systems, management-information systems, systems utilizing integrated data bases figure more and more among the processing objectives of users.

But as the computer and its functions grow in complexity, the task of systems design becomes more difficult. Effectively automating an order entry application, for example, is by no means as formidable a project as implementing a system that involves 20 application areas, or one that is geared to respond in minutes to unanticipated inquiries about any element in the data base. The problem of defining the best systems solution increases with the scope of the system being developed. Recognition of this fact has led to the establishment of formalized techniques intended to aid the systems planner in his approach to the design of large-scale systems.

Valuable though these techniques are in directing the systems study, they suffer significant limitations: they neither lessen the effort nor significantly reduce the amount of time required to carry out a study. They provide a plan of action, but rely totally upon manual effort for execution of the plan. Where advanced systems concepts are to be realized, dependence on manual techniques alone is an obstacle to design. An examination of why this is so will lead to an understanding of the benefits to be gained from use of the Time Automated Grid system (TAG).

Systems Design Problems

Systems design is always subject to certain obstacles. Large-scale systems design is subject to a magnified version of these same obstacles. The difficulty of properly surveying system requirements – current and future – of drawing up design objectives, and of defining the optimum solution to a systems question is intensified when the area under study is vast. The time and staff required to perform a thorough study increase in proportion to the scope of that study. In most instances of large-scale systems design, however, both time and personnel are limited.

Systems specialists represent a very small percentage of the total staff within any company. Yet their job requires that they accurately research all, or a great portion, of the activities in which the corporation engages. The quality and the amount of work that the systems group can accomplish in a given time-span depends upon the number in the group and their experience in the systems field. This is true whether the system under consideration is restricted in scope or is all-encompassing. But designing a large, integrated system makes greater demands upon the talents of the systems group than does development of a more limited system. Therefore, where advanced concepts are to be implemented, some means of increasing productivity – of obtaining more from the study team – must be found. One way to do this is to expand the systems group to an optimum size. However, attempting to increase team size causes additional problems.

First, skilled systems analysts are not always readily available. Second, when hired, they must be trained in company procedures before they can participate efficiently in design work. Once that work is completed and a new system is implemented, personnel requirements may undergo a change. Where fewer analysts are needed to maintain a system than were required to assist in its design, the question arises of how to continue utilizing the additional staff members. Perhaps most significant of all is the economic question – how to justify and absorb the costs entailed.

If supplementing the study team is not the answer to maximizing productivity, perhaps the next best solution might be an increase in the amount of time allotted for the systems study. Yet experience has shown that extending the period of time between the start of a study and implementation of a system is usually not feasible. Need for a speedy solution to the problems that made redesign of an existing system necessary in the first place is one reason. The dynamic quality of any business organization is another. A company's goods, the services it provides, its internal structure and procedures vary with the passage of time. In a rapidly developing corporation, changes may occur in a matter of months. Changes will almost always occur over a period of years. To design a unified system with an integrated data base in an evolving environment is like trying to hit a moving target. Design objectives that are valid at the beginning of the study project may no longer be so, or may be only partially so, six months or a year later. Requirements that did not exist at the start of the design phase must be incorporated into work already completed. Evaluation and communication of changes and of their effects on the final system design must take place. All this requires additional time and can push implementation of the system still further into the future.

Obviously, if increased productivity cannot be achieved by augmenting either systems personnel or the time to be given over to the systems study, the technique employed to direct the study should provide a means of attaining this goal. Conventional study-directing techniques cannot do so because, being manual, they require time-consuming, laborious effort on the part of the systems planner.

Documentation and reduction of data, and the organization of it into a systems flow, are all done by hand. Currently, the clerical portion of systems design work can require as much time as its creative or decision-making aspects, if not more. Given this situation, plus limitations in staff and study time, it is highly possible that important design questions may be neglected or glossed over. Failure to probe deeply enough adversely affects the quality of the systems solution. Ideally, the study team should be able to weigh the value of all the data it collects, search out discrepancies and redundancies in the data base, examine all the alternative solutions to the systems question and the effects of each solution on the total design. In reality, systems planners are often forced to accept a less than optimum design. Sacrifices in quality are made to ensure completion of the systems task within a reasonable time-span. For example, we know that functional areas within a business organization may overlap one another. Data passes between them. What is output in one area may be input to another. In order to design a unified system, the analyst must be aware of when and how data elements cross the barriers between functional and operational areas. Developing this awareness can demand an expenditure of time that the systems planner cannot afford. Consequently he may choose to study each activity within his company as though it were a self-contained entity isolated from all other activities. Maintaining an overview of the system then becomes virtually impossible. The concept of system unity, or integration, is lost.

The key to effective design lies in giving over more of the available study time to the decision-making processes and in making it easier for the systems planner to reach conclusions about data requirements. If the systems analyst must rely on his own data-recording and organizing abilities (as he has had to do in the past), his productivity cannot be as great in the purely inventive area of design. What is needed is a technique to relieve him of his clerical duties while directing him in his creative efforts. That technique is TAG.

TAG-Assisted Systems Design

Originally developed as a manual systems design tool, TAG was automated late in 1966. TAG is a general-purpose technique applicable to the design of any data-processing system in the commercial environment. Its use is not limited to a particular industry, application, or hardware configuration. With TAG, the user systematizes his study effort while reducing study time and maximizing the creative utilization of personnel. Although TAG is not an "instant" systems design tool – that is, it does not eliminate the need for systems analysts – it is of significant assistance in all areas of systems work: data collection, analysis of data requirements, and definition of data flow.

Use of TAG begins with transcription of the system's output data requirements on an Input-Output Analysis Form. Because the form is simple, those who fill it out need not be experienced systems personnel. The user can draw upon his operational, programming, and control staff in the survey effort, leaving his systems staff free to review the completed work and to direct their attention to questions that require further investigation. Employment of personnel over and above the systems team affords greater speed in the data collection effort, and means that the analysis and design phases of the systems study can begin earlier than they otherwise would. Standardized documentation of systems requirements and upgrading of personnel in systems operation are by-products of the TAG procedure.

The tasks of analysis and design occur earlier in a TAG-assisted study for a second reason: initially, only a portion of the systems information available need be studied before analysis may begin. TAG looks first at the user's output requirements only. Inputs are examined during later iterations of the program.

Once the output data requirements have been fed into the TAG system, TAG works backward from the output to determine what inputs are necessary and at what point in time. As a result of its output-oriented approach, TAG is able to define a minimum data base for any system. With the aid of the reports generated by TAG, the user can systematically resolve the question of how the required inputs are to be entered into the data flow. He is assured of defining only pertinent input elements and of bringing them into the system at their proper place, all with minimum effort on his part. Superfluous or repetitious data can be identified and eliminated from the system. Discrepancies in the use of any data element can be corrected.

When both inputs and outputs have been defined to TAG, the next iteration of the program produces file format and systems flow descriptions. File contents and data flow are both based upon time – the time at which data elements enter the system and the time at which they are required to produce output. To TAG, it is the elapsed time between these two moments that creates the need for files. The files that TAG defines indicate, in detail, what data must be available in each time period to enable the system to function. The job definition depicts the flow of these files, as well as of the inputs and outputs, within and between time cycles. The user obtains an overview of his system, showing the interrelationship of all data in the system. Knowing these interrelationships makes it possible for the system planner to determine whether the outputs desired are quickly and easily obtained, and thus economically justified. With knowledge of the availability of data elements in given time periods, he can readily see where additional useful outputs might be obtained. His creative ability is enhanced. The information provided by TAG allows the analyst to do a more thorough, knowledgeable job of systems design.

With the job definition before him, the user then decides how he wishes to proceed. He may define further data requirements or he may begin optimizing the system flow. The user studies as much or as little information as he chooses at any one time – a few application areas or the operations of the entire business organization. The size of the study is restricted in no way by the use of TAG. TAG is an iterative tool; its function is to develop an integrated systems flow and to maintain that integration no matter how many changes or how much additional data the user introduces. And TAG will do so accurately and at computer speed. Limited time need not be the obstacle to effective design that it is when manual techniques alone are used. An analyst can experiment with any number of alternative solutions – for a single application or a total system – and arrive at the best one in much less time than he could using manual methods. Users of TAG can convert systems in parts, according to the timetable most convenient for them, without encountering difficulty in tying in other application areas later. If a company's data requirements change at any point during the systems study, new requirements can rapidly be analyzed by TAG and incorporated into the existing job definition. In short, the TAG user obtains, in systems analysis and design, the same flexibility he seeks when he automates application areas.

To summarize, use of TAG permits a reduction in the time and effort required to go from problem definition to systems implementation, maximizes the creative use of systems personnel, and produces as an automatic by-product standardized, up-to-date documentation.

TAG INPUT/OUTPUT ANALYSIS FORM

All user data to be analyzed by the Time Automated Grid system is recorded on the Input/Output Analysis Form (X20-1779). An illustration of the form appears in Figure 1.

The form is divided into two horizontal sections, one dealing with requirement titles, the other with data names. The characteristics of the input, output, or file being described are recorded in the requirement title section. Comments and the data requirements of the input, output, or file in question are detailed in the data name section.

1. Requirement title section: Title information is recorded in columns 1-70. The name field is left-justified; all other fields are right-justified. Leading zeros are not required.

Column	Field Name	Contents
1	Data Type	I (input), O (output), F (file)
2	File Code	Present only if column 1 is F. R indicates a reference file (input); A indicates an audit file (output).
3-5	Frequency	Number of times this title name is processed
6-7	Period	Shortest clock or calendar time period within which this data is processed. Possible periods and their codes are second (S), minute (MI), hour (H), day (D), week (W), month (MO), quarter (Q), year (Y). (Frequency plus period establishes a time interval.)

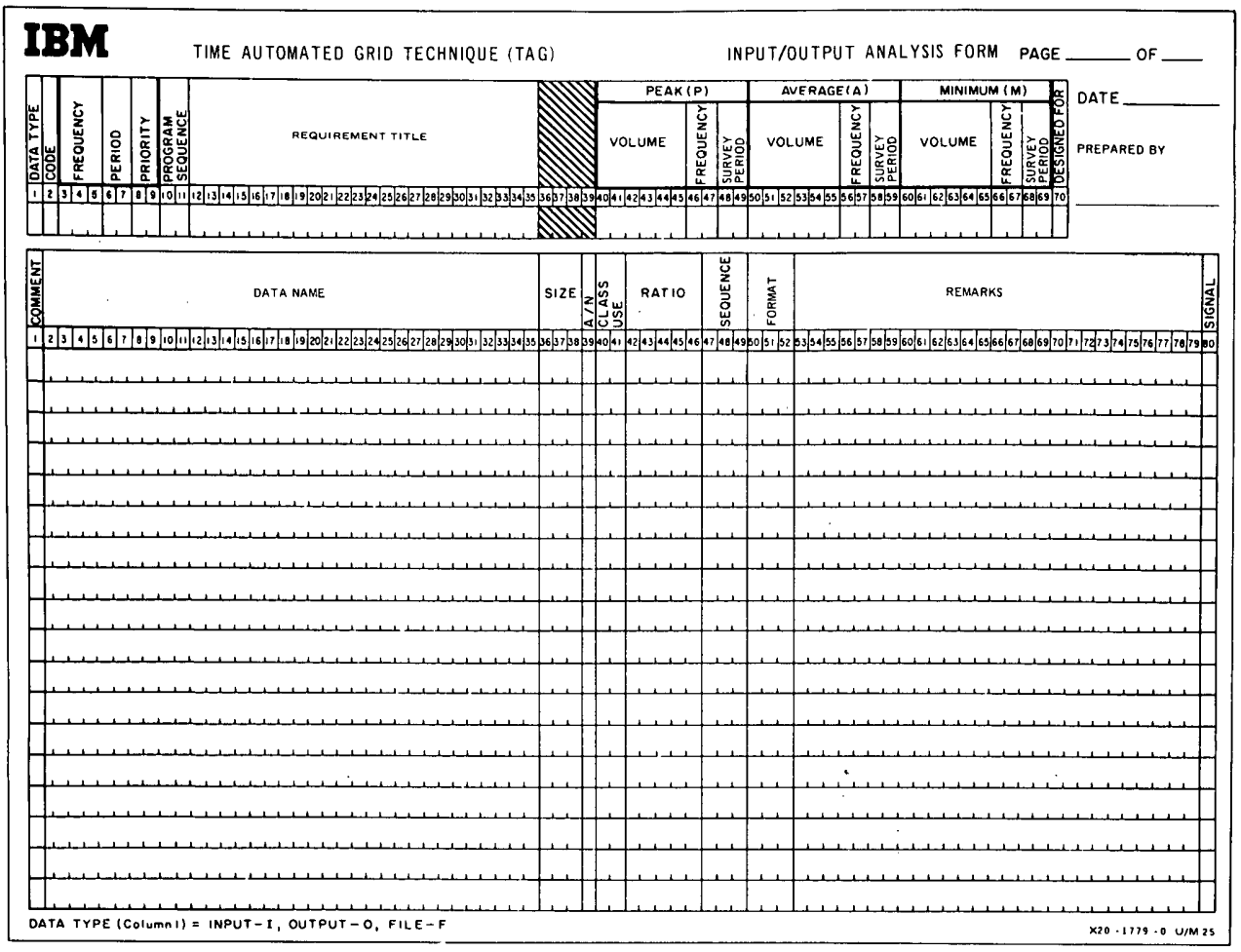


Figure 1. TAG input/output analysis form

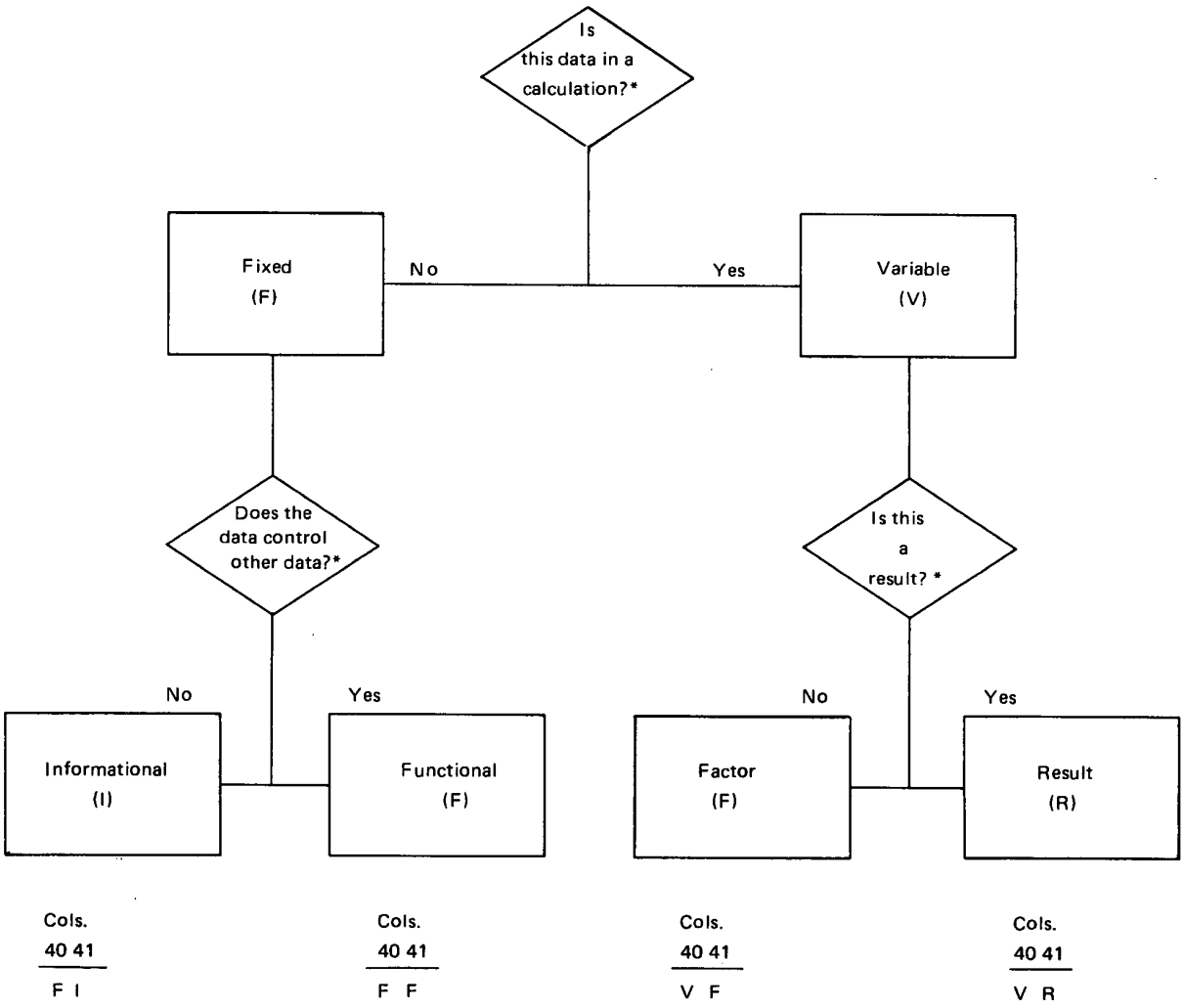
Column	Field Name	Contents
8-9	Priority	Sequence of inputs and outputs within a time interval. Ranking is from 1 to 99, with 1 being highest priority. All requirements not having a priority indicated will be assigned the lowest priority, 99.

TAG uses the frequency, period, and priority information to establish what is called a cycle number. TAG begins with the smallest interval of time designated by the user (e.g., 999 times per second) and works up to the largest, incrementing the cycle number by one each time there is a change in frequency, period, or priority. All requirements with the same frequency, period, and priority will be assigned the same cycle number. (Note that initial assignment of priority cannot be made by the user until all documents for a given frequency and period have been reviewed together. Therefore, in most cases, it is suggested that priorities not be assigned until after the first iteration of TAG.)

Column	Field Name	Contents
10-11	Program Sequence	Not used with TAG
12-35	Requirement Title	A unique name for the input, output, or file (Column 12 may not be blank.)
36-39		Blank
40-69		Peak, average, and minimum volumes, with their associated frequency of occurrence and survey periods
40-45	Volume	Quantity of inputs or outputs noted during the survey for the time period indicated in columns 6-7
46-47	Frequency	Number of times the volume indicated occurred during the survey period
48-49	Survey Period	Study period or time during which the volume information was gathered
50-55	Volume	See 40-45
56-57	Frequency	See 46-47
58-59	Survey Period	See 48-49
60-65	Volume	See 40-45
66-67	Frequency	See 46-47
68-69	Survey Period	See 48-49
70	Designed for	The volume figure for which the design is intended (P-peak, A-average, M-minimum)
71-80		May contain user ID

2. Data name section: The data name information is recorded in columns 1-80 of the I/O analysis form. The name field is left-justified; all other fields are right-justified. Leading zeros are not required.

Column	Field Name	Contents
1	Comments	When the letter C is entered in column 1, TAG treats columns 2-80 as a comment. Comments may be in any form – an English statement, a FORTRAN formula, a COBOL sentence. If there is no C, it is assumed to be a data description line.
2-35	Data Name	Data field name
36-38	Size	Total number of characters in the data element
39	Alphabetic/ Numeric	N for an all-numeric item, A for all others
40-41	Class-Use	Describes the characteristics and the use of the data element. There are four categories into which data may fall: fixed informational; fixed functional; result of calculation; factor in a calculation. When coding Class-Use refer to Figure 2.



*With respect to this requirement only

Note: For data names coded VR, all factors needed to calculate that result should be listed as data elements even when they do not print on the document. If possible, show on a separate line, as a comment following each VR, the formula used or computations required to arrive at the result.

Figure 2. Chart for coding of class-use

Column	Field Name	Contents
42-46	Ratio	The average number of times the data element is required in a unit of the title requirement. Ratio will vary depending upon the unit of measure used to express volume.*
47-49	Sequence	Used for data elements that control the sequence of the input or output. Sequence is indicated as 1 (major control field), 2 (intermediate control field), etc. A maximum of 15 control fields will be accepted. Sequence should be indicated for at least one data element within a title name. Sequence elements must be listed whether or not they appear on the output.
50-52	Format	Indicates the order (left to right and top to bottom) in which the data elements appear on the requirement. If format is unimportant, enter a P in column 52. On an output, if the data element is not to appear, leave columns 50-52 blank.
53-79	Comments	May be used for any explanatory comment
80		0, 1, 2 used to modify summary codes. Use with caution!!!!

*For example, assume that a payroll register contains one printed line per employee and that there are 1000 employees. The volume figure for the payroll register may be expressed in terms of the number of lines in the register (1000), or in terms of the number of pages in the register (assume 20), or in terms of the number of registers to be produced (1). If each employee's name is to appear on the register, the ratio figure for "employee name" would be 1 if volume = 1000 lines, 50 if volume = 20 pages, or 1000 if volume = 1 register.

TAG REPORTS

The output of the Time Automated Grid technique is a series of ten reports that document the user's input, analyze his data requirements, and provide file and data-flow definitions. All reports and their suggested method of utilization are explained below.

Report 1 – User's data: The first report generated by TAG is a listing of the cards keypunched from the data on the I/O analysis form. All information, including comments, is shown. Accompanying each requirement title is a sequential number called an entry number, which is assigned to the requirement as it is read into the TAG system. In addition, each card processed is given a unique card number. This listing provides the user with a record of data analyzed to date.

Report 2 – Glossary of data names: Each of the unique data names submitted to TAG by the user is listed, in alphabetic order, within the glossary.* The size, characteristics, and reference number associated with each field are printed beside the field name. The glossary provides documentation and a guide for standardization of terms.

Report 3 – Document analysis: Once all requirement titles and their data elements have been fed into the TAG system for analysis, TAG sequences the user's inputs and outputs by priority (01-99) within time interval (999 times per second to once per year). A cycle number is then assigned to each unique time-priority designation. Next, the requirement titles are sorted to type (input, output, reference file, audit file) within cycle, and are given a number by the TAG system called a "header" number. Report 3, the document analysis, is in header-number sequence with a cross-reference to I/O entry number. It summarizes all the requirement titles that have been analyzed, and describes the systems study in terms of the number of headers being examined, their volume, the cycle in which they occur, and the number of alphabetic and numeric characters they contain.

Report 4 – Sorted list of data names: This listing records, in alphabetic sequence by data element, each usage of an element the way it originally appeared on the I/O analysis form. The cycle, the header number, and the header type for which the data name is required appear with it. For ease of reference, the card number associated with each element is printed beside it. The sorted list may be used to resolve discrepancies and redundancies in data names, field sizes, and contents. Duplicate data names can be deleted; number and type of characters contained in data fields can be standardized with the aid of this report.

*Not included in Sample Problem, Appendix C.

Report 5 – Time-grid analysis: To produce Report 5, TAG reduces the Sorted List of data names to unique elements. The data numbers previously assigned to the elements are then printed across the page, 20 per page, and the headers in which the data elements appear are printed, in sequence by time, down the page. The figures shown within the grid describe the number of appearances of the element within a particular header. Below each grid, following the last header analyzed, is a line of summary codes – one or more for each data element within the body of the grid. A legend explaining the codes is printed at the bottom of each page of the report.

Use of this grid makes it possible to trace the appearance of each data element, by time, through all the requirements in the system. The grid indicates those data elements that must be carried in files (summary code 1). Thus the time-grid analysis enables the reviewer to begin identifying the minimum data base his system requires.

Elements that may be generated by the system itself are also pointed out by this report (summary code 2). Where these variables are the result of calculations, a check should be made by the reviewer to ensure that all the factors required to produce those results have been included in the system.

Report 6 – Summary of unresolved conditions: All data elements needing further investigation are listed here. These include items:

(a) for which there is no input (summary code 3)

(b) which are not required to produce output (summary code 4)

(c) whose ratio varies from requirement to requirement (summary code 5)

(d) which must be produced before the necessary input is available (summary code 6)

(e) which are duplicates of other data elements required by the same header (summary code 7)

Using this information, the analyst must now determine which of the conditions listed are truly error conditions and decide how he wishes to resolve them. Only he can determine, for example, whether variation in ratio is an error or simply the way in which a data element is used, whether an unused input item is superfluous or will be required by an output not yet submitted to TAG, or whether a needed element should be introduced in a file or on a document. (For a detailed discussion of the TAG – generated summary codes, see appendix B.)

Report 7 – Time/key analysis: The time/key analysis lists each header and its characteristics: volume, type, the cycle during which the header is inputted or created, and the key elements associated with it. By examining the time and sequence requirements for each header in relation to all other headers, the analyst can easily see where sequencing problems exist or sorts are required. If he uses the time/key analysis in conjunction with the time-grid analysis, he can determine the best possible source from which to draw missing input elements, since the two reports taken together provide a simple means of matching outputs and inputs having like key elements and time requirements.

On the basis of the information contained in the preceding reports, the analyst makes corrections and changes to the data originally submitted to TAG. Once the modified user information has been fed into the TAG system, a second series of reports is produced. The first seven will be the same as those described above, updated to reflect all changes. If all input requirements have been defined, TAG constructs working files to communicate between the time periods in the system.

TAG utilizes two approaches to file design – the serial method and the direct access method.

Report 8 – Serial file records: In the serial approach, TAG limits the amount of data in any one record to a required minimum. Although TAG has no way of applying volume and activity figures to the files it constructs, the assumption is made that passing superfluous data through a cycle is costly in terms of time. The underlying philosophy is that the fewer the characters in a single data record, the less read/write time is required to process it, and the shorter a record, the greater the number of records that can be contained in a block of given size. Therefore, TAG attempts to minimize the data base within each individual file. It does this by building a new serial file whenever a sequence change in the required data occurs or a time change between the availability and use of data takes place in the system. This approach results in a multiplicity of files, and can be considered the worst solution to the problem of file format definition.

Report 9 – Direct-access records: The unrestricted use of direct-access files is the second design alternative outlined by TAG. In this solution, no attempt is made to minimize record size, the concept being that inactive records need not be passed when files are retained on direct-access devices. Therefore, more data than is required in any given time period may be maintained on a file without significantly degrading system performance within a cycle. Using this approach, TAG constructs files on the basis of sequence changes only. Time requirements are ignored. The result is fewer files, but larger data records than exist in the serial-record solution.

Report 10 – Job definition: All working files, inputs, and outputs for each time interval (cycle) in the system are brought together in Report 10. A job definition, or data flow, is produced for each of the two file types – serial and direct access.

The result of TAG's analysis is a basic working system, which has been divided, by time intervals, into several subsystems. Although it is, by no means, an optimum solution and is not based on actual volume figures and hardware considerations, nevertheless it does provide a definition of the minimum data base required to satisfy output objectives in each cycle. Using his knowledge of record volume and activity, and of the equipment available to him, the analyst must now optimize the data flow. Content of files and time requirements for files, in detail, have been established for him by TAG. He may now work out the most feasible solution to the requirements of the total system or to any one of the subsystems. Each of the subsystem solutions may then be reassembled into a total systems design, using as interfaces between them the working files described by TAG. At any point in the optimization process, the analyst can again submit his data to TAG and receive an updated set of reports showing the effects of the changes he has made upon the entire system.

The Time Automated Grid technique can be used to best advantage in the development of the management information system. TAG is particularly well suited to the design of large-scale systems, where diversified activities, requiring numerous outputs, are to be brought together and supported by an integrated data base. Effective utilization of TAG, however, is by no means restricted to this specific design situation alone. The technique offers valuable assistance to the analyst wherever the need to define a system's minimum data requirements exists. The "system" in question may represent a single activity area with a high volume of output; it may comprise multiple applications; it may be manual or mechanized. No matter what the nature of the system, TAG will aid the analyst in defining, or refining, a data base and information flow. For example, when TAG is applied to the development of a paper-flow system, the output generated by the tool provides a reference guide to the inventory of information to be maintained and the documents to be processed within the system. If the design problem under consideration is one of cut-over from unit-record equipment to a computer, TAG alerts the user to the existence within his present system of the redundant data elements that frequently characterize a card-oriented installation.

Use of TAG need not be limited to the area of design. By altering the type of information designated as input or output, the systems analyst can employ TAG to study subjects such as file conversion or the feasibility of implementing a particular application package, given the contents of existing files. TAG is a flexible tool; there are no rigid rules about how it may be employed.

EVALUATION OF TAG

It is recommended that, prior to undertaking a full-scale study, the potential TAG-user evaluate the technique using data of his own choosing. He should plan to conduct a small pilot study involving approximately a dozen outputs with varying time requirements. The pilot will serve to familiarize the user with TAG's concepts and will afford him the opportunity to compare the technique to other design methods. A careful examination of the results of the study, in terms of effort expended and work accomplished, should show the systems planner whether or not TAG can be of benefit in his particular design environment.

After TAG has been evaluated and accepted as the study-directing technique, the systems project proceeds as it would were conventional design methods used. It is important to remember that TAG does not eliminate any of the essential "ingredients" of the design process. Data collection, analysis, and system definition are components of any design project, whether TAG-assisted or not. However, TAG makes it possible to accomplish these tasks more quickly and more systematically than do "paper-and-pencil" techniques.

UTILIZATION OF TAG

1. Systems team: The services of at least one experienced systems analyst are required to implement a TAG-directed study. During the survey phase of the systems project, his task is to delegate responsibility for the collection of data, to resolve questions about that data, and to coordinate and monitor the work of the staff at his disposal.

The personnel who make up the survey team may be drawn from any functional area the systems planner desires. The major criterion for effective participation in the study at this point in the project is a familiarity with some phase of the activity being reviewed. If, for example, a department employs clerks who regularly handle certain documents, the clerks could be asked to transcribe the requirements of the documents on I/O analysis forms, for later review by an analyst.

The size of the survey team that an analyst can effectively supervise will, of course, depend upon the competence and systems experience of the individuals in the team. Non-systems personnel, for example, might require more direction from the analyst than systems trainees; and, therefore, a group made up of nonsystems people might, of necessity, be smaller than one composed of systems personnel. Nevertheless, no matter what the characteristics of the study team, TAG can significantly enhance the ability of the analyst in charge to delegate the "clerical" or nondesign portion of systems work to the other members of the team.

Upon completion of the data collection effort, full responsibility for the remainder of the design project reverts to the experienced analyst, whose job it then becomes to study the reports generated by TAG, investigate unresolved conditions, and design a system that is in keeping with specific hardware and file considerations.

2. Design steps: The first step in the design process, after selection of the activity or activities around which development of a new system is to begin, is the gathering of known facts about systems output requirements. The details of what is needed to create these outputs are coded on I/O analysis forms, reviewed by an analyst, keypunched, and submitted to TAG. The initial analysis of the user's data will pinpoint errors and discrepancies in data definition, such as inadvertent duplication of data names or incorrect variations in the descriptions of data fields and their contents.

In all likelihood, the usage of certain terms will require standardization; and the study team may wish to use the glossary provided by TAG for this purpose.

Following the correction of error conditions and the resubmission of output data requirements to the TAG system, the analyst begins assigning priorities to system outputs. Priorities can be assigned only after all of the outputs for a given time period have been reviewed together. With the aid of the reports created by TAG, the analyst redefines the time intervals at which output must be produced. Since he is aware of the over-all relationship among data items and outputs, he is in a position to settle any conflicts that may arise over relative priorities of output. For the same reason, he can also recognize possibilities for new and improved outputs.

When outputs, their characteristics, and their time requirements have been firmly established, TAG directs the user to the items needed to produce those outputs (code 3). Using the report of unresolved conditions as a checklist, the analyst now considers the question of availability of input data. It is up to him to select the most feasible method of entering required data into the system. He must analyze the nature of each input element to be introduced. Is it the kind of item that the system itself has available – a constant or the result of a calculation? If it is not, then the element must be brought into the system via a document or a reference file. The document solution will be the one chosen when an item must be reintroduced each time it is used.

Since this is obviously the most unwieldy and costly manner of entering data into the system flow, the analyst should be absolutely certain that no other answer to the input question exists. If, on the other hand, the analyst determines that a data element can be used over again once it has entered the system, then that element must be incorporated into a reference file, and the analyst must consider the problem of file maintenance. Once method of entry has been established, the analyst approaches the question of when in time to introduce the document or file and the problem of what other elements – key fields and additional data fields – are to be brought in with the required input items. Here again, an examination of the TAG-generated glossary and analysis will help him find valid response to these questions in a shorter time and with less effort than might otherwise be possible.

The final stage of the design project is, as always, system definition. After TAG has processed the required information on user inputs, outputs, and files, data and job description reports are created that provide a word picture of the user's system, or that portion of it that has thus far been analyzed. The analyst now refines the generated file format and data-flow descriptions, applying to them record volumes and activity ratios, and, if known, hardware considerations. He looks for possible new outputs and improvements to existing ones. He may change the contents of an output, its priority, and the frequency with which it is produced. He may consolidate duplicate reports. Since he can trace the steps needed to produce desired outputs, the analyst knows the relative ease or difficulty with which those outputs are obtained. Thus, he can justify eliminating from the system costly reports – ones that require excessive data manipulation to produce.

In designing files, the systems planner first compares the contents of existing reference files to the data requirements outlined by TAG. Where discrepancies exist, the analyst determines whether or not it is feasible to attempt to include the needed data in the system. If it is feasible, then he must locate the source from which the input is to come and make some decision about when and how to incorporate that data into new files. A study of this question may lead to the establishment of plans for future file conversion. The final criteria of design must be based on volume and activity figures for the data records in the system. Working from the format definitions supplied by TAG, the analyst must develop a data base compatible with these figures and with the hardware and configuration of the proposed system. Often, the final design choice will be one based on economic considerations. The analyst redefines file formats and data flow, working within the boundaries of each established time interval, until he has achieved an optimum system. Changes made in the original job and data definitions may, of course, be submitted to TAG for analysis. Doing so will ensure that such changes do not result in any new unresolved conditions and do not destroy the integration of the previously established data base.

As stated earlier, the steps outlined above are ones that would have been necessary whatever technique was utilized to aid the systems planner. The Time Automated Grid technique assures more rapid and more effortless accomplishment of these steps by providing direction and computerized analysis of requirements.

Appendix A: Basic Rules For TAG Input/Output Analysis Form

This appendix provides the basic rules for completing the TAG Input/Output Analysis Form. For more complete information see the section of the manual titled Use of TAG.

All fields except requirement title and data name are right-justified. Leading zeros may be omitted.

Requirement Title Line

Col 1	Data Type	I – input O – output F – file
2	File Code	R – reference file A – audit file
3-5	Frequency*	Must be numeric (number of times processed in period of document or file requirement)
6-7	Period*	S – second MI – minute H - hour D – day W – week MO – month Q – quarter Y – year
8-9	Priority*	Must be numeric (1 is highest priority)

*Note: Any change in Frequency, Period, or Priority will cause TAG to generate a new cycle.

10-11	Program Sequence	Not used in TAG
12-35	Requirement Title	Column 12 may not be blank
36-39	Not used	Should be blank
40-45	Volume (peak)	Must be numeric
46-47	Frequency	Must be numeric
48-49	Period of study	See codes for columns 6-7
50-59		See rules for columns 40-49
60-69		
70	Designed for	P, A, or M
71-80	Not used	May be used for customer ID

Data Name Section

Col 1	Comment	C if columns 2-80 contain a comment; otherwise blank.
2-35	Data Name	Column 2 may be any nonblank character
36-38	Size	Numeric
39	A/N	N if contents numeric A if contents alphabetic or mixed
40-41	Class-Use	FI FF VR VF
42-46	Ratio	Must be numeric
47-49	Sequence	1 is major – up to 15 sequence fields
50-52	Format	Either numeric or P if field is to print or is present in input or file; otherwise blank
53-79	Comments	Any comment
80	Signal	Should be left blank initially. It may be used later to enter certain corrections.

Appendix B: TAG Summary Codes

TAG analyzes each data element handled or produced by the user's system and lists its findings, in the form of code numbers, below each Time-grid analysis (Report 5). One , two, or three codes will be present for every data element in the grid.

Code 0

A summary code of 0 attached to a data element indicates (1) that the element is available at the time it is required to produce an output and (2) that no variations in ratio exist between input and output.

Code 1

Items that are needed in multiple cycles and must, therefore, be incorporated into files are flagged with a code of 1. These elements will constitute the minimum data base of the system defined.

Code 2

Any data element that the system itself has available or can generate, such as a constant, is considered a variable result, and will have a code of 2 associated with it. When such a variable is the result of a calculation, a check should be made to ensure that the factors needed to produce the result have been included in the data flow.

Code 3

In the case of missing input (summary code 3), the analyst must decide (1) whether the system itself can generate the element, (2) whether the element can be reused once it has been introduced, or (3) whether the element must be re-introduced into the system each time it is required. If the analyst chooses the reference file solution, he should next ascertain what other data elements are to appear in that file. In other words, he must identify the control information required to link his file to the output it produces and to other files.

Occasionally the reviewer may find that the problem of undefined input is merely the result of an error in data description – that an input element and an output element that should have exactly the same name and characteristics have been defined differently. Where this is so, it may be possible to match an item with a summary code of 3 to one having a code of 4 – "input but no output".

Code 4

When a code of 4 cannot be resolved by this matching process, it may mean that the data element in question is superfluous or that the output requiring that element has not been introduced into the TAG system.

Code 5

Analyzing a summary code of 5 – "ratios not equal" – calls for a review of the documents or files in which the questionable item appears. The unit of measure used to express the volume of the input or output, the time requirements involved, and the way in which the data element itself is used determine whether or not ratio variations represent errors. For example, an item may appear 1000 times within a file, 100 times on a daily register, and 500 times on a weekly report. It is up to the systems analyst to ascertain whether these variations in usage are valid or are the result of inaccuracies in volume or data specifications.

Code 6

A summary code of 6 associated with a data element denotes a time inconsistency between availability of the element and need for it: requirement for the use of the item precedes the item's entry into the data flow. This condition can be resolved by assigning the same frequency, period, and priority to both the input on which the data item is introduced and to the output by which it is required.

Code 7

Duplicate data fields – those with the same name and characteristics – defined within the same document or file are flagged with a code of 7. Where such duplications occur, the analyst should eliminate all but one of the appearances of the data name and increment the ratio figure for that name, where necessary.

Corrections to T.A.G. manual (Y20-0358-0)

P. 34 Paragraph 1 - second sentence should read:

File 2 contains data elements that . . . . .

Paragraph 2 - should read:

File 1 contains

Paragraph 3 - should read :

. . . . . required by the weekly shipment report (header 7) in cycle 3.

P.35 Paragraph 2 - second sentence should read:

Direct - access file 2 combines serial files 2 and 4.

A schematic of the sample problem illustrating TAG appears in Figure 3 followed by a narrative. Samples of the documents used in the problem are shown in Figures 4 through 7. The data requirements of these documents, transcribed onto Input/Output Analysis Forms, are pictured in Figures 8 through 12.

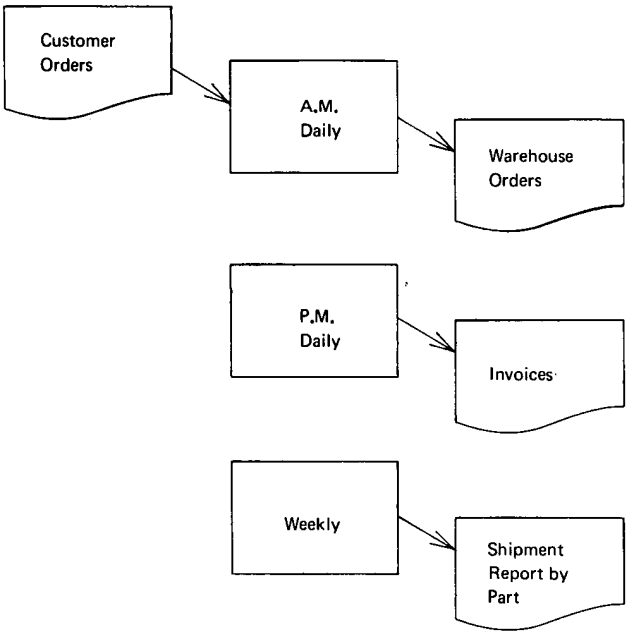


Figure 3. Schematic of sample problem

DATA PRESENTATION

Warehouse orders are prepared daily in the morning from customer orders. Invoices are printed in the afternoon. A report of shipments by part is printed on a weekly basis.

An average of five parts are ordered and shipped for each customer. One out of five parts is completely out of stock or partially shipped. Back orders are handled manually; however, out-of-stock quantity is shown on the invoice.

Order numbers are assigned clerically in the sales department on receipt of the customer order and enter the system in that sequence. The warehouse orders and invoices are printed in sequence by part size and brand (minor) within part code (intermediate) within order number (major). The customer qualifies for a higher discount rate if his total invoice amount is $1000 or more. Customers are billed for quantities shipped. Any adjustment to the discount rate required because of a difference in quantities ordered and shipped is made manually and does not affect the system.

As shown on the weekly shipment report, which is printed in part code, part size, and brand sequence, an average of 10 customers order each of the 25,000 different parts (size and brand combination included) weekly. A total of gross amount shipped, i.e., quantity times price before discounting, is printed for each part.

Normally the first I/O analysis sheets are prepared for output requirements only, but the customer order in this problem is such an obvious input to the system that it is included initially. The volume figures for all requirements are taken from a typical week. Note the use of comments to include information about the data names which may be of later use in programming. Although this information is not required when filling out the analysis sheets, it can be recorded for later use. Some comments may be of this informational type; others may be used to make machine language processing statements. The type of comment depends on the experience of the person filling out the forms. Since TAG is intended to save time in systems design, it would not be practical to require people to gather such information or learn a programming language.

CUSTOMER COMPANY
CUSTOMER STREET ADDRESS
CUSTOMER CITY, STATE

Customer

Date nn/nn/nn

Order Number nnnnnn

Our order no. nnnnnn

OUR Company
Our Street Address
Our City, State

SHIP TO Another Customer Address
Another City, State

Credit Code n

Qty.	Part Code No.	Size & Brand
nnn	nnnnnn	nnn
nnn	nnnnnn	nnn
nnn	nnnnnn	nnn
nnn	nnnnnn	nnn
nnn	nnnnnn	nnn

Special Shipping Instructions: _____

Figure 4. Sample customer's purchase order

OUR COMPANY
WAREHOUSE ORDER

Customer Order Number nnnnnn
Our Order Number nnnnnn

SHIP TO Customer Company
Another Street Address
Another City, State

Qty.	Part Code No.	Size & Brand	Part Name
nnn	nnnnnn	nnn	aaaaaaaaaa
nnn	nnnnnn	nnn	aaaaaaaaaa
nnn	nnnnnn	nnn	aaaaaaaaaa
nnn	nnnnnn	nnn	aaaaaaaaaa
nnn	nnnnnn	nnn	aaaaaaaaaa

Special Shipping Instructions: _____

Figure 5. Sample warehouse order

OUR COMPANY
OUR STREET ADDRESS
OUR CITY, STATE

Our Order Number nnnnnn Customer Order Number nnnnnn Invoice Number nnnnnnnn

Sold to: Customer Company
Customer Street Address
Customer City, State

Shipped to: Another Street Address
Another City, State

Quantity Ordered	Quantity Shipped	Quantity Out of Stock	Part Code Number	Part Size & Brand	Part Name	Price	Amount
nnn	nnn		nnnnnn	nnn	aaaaaaaaaa	XX.000	XXXX.00
nnn	nnn	nnn	nnnnnn	nnn	aaaaaaaaaa	XX.000	XXXX.00
nnn	nnn		nnnnnn	nnn	aaaaaaaaaa	XX.000	XXXX.00
nnn	nnn		nnnnnn	nnn	aaaaaaaaaa	XX.000	XXXX.00
nnn	nnn		nnnnnn	nnn	aaaaaaaaaa	XX.000	XXXX.00

Less Discount @ .00 XXX.00

TOTAL AMOUNT DUE $XXX,XXX.00

Credit Code n

Figure 6. Sample invoice

OUR COMPANY
WEEKLY REPORT OF SHIPMENTS

Part Code	Part Size & Brand	Part Name	Customer Name	Quantity Shipped	Value	Total
nnnnnn	nnn	aaaaaaaaaa	-25-	nnn	XXXX.00	
			-25-	nnn	XXXX.00	
			-25-	nnn	XXXX.00	
			-25-	nnn	XXXX.00	
			-25-	nnn	XXXX.00	
			-25-	nnn	XXXX.00	
			-25-	nnn	XXXX.00	
			-25-	nnn	XXXX.00	
			-25-	nnn	XXXX.00	
			-25-	nnn	XXXX.00	
						XX,XXX.00
nnnnnn	nnn	aaaaaaaaaa	-25-	nnn	XXXX.00	

Figure 7. Sample weekly report of shipments

I/O ANALYSIS FORMS

Columns 3-9 in the requirement title portion of the I/O analysis sheet are used to describe, in terms of frequency, period, and priority, the availability of input or the time requirement of output.

In the problem, the I/O analysis forms for the customer order, warehouse order, and invoice are shown in Figures 8-11 and all have a frequency and period of once daily (1D). The customer and warehouse orders both have a priority of 1, meaning that they are required first in the daily operation. The invoice has a priority of 2, indicating that invoice preparation occurs at some time after preparation of warehouse orders. Priority for the weekly shipment report cannot be determined at this point and has been left blank. TAG will assign the lowest priority (99) to this report.

Columns 40-69 in the requirement title portion of the I/O analysis form are used to record volume. Although TAG does not analyze this data, the volume figure for which the design is intended (as specified by column 70) is printed on several of the TAG reports. In the case of the warehouse order, the peak daily volume is 8300, the average volume is 7800, and the minimum daily volume is 7400.

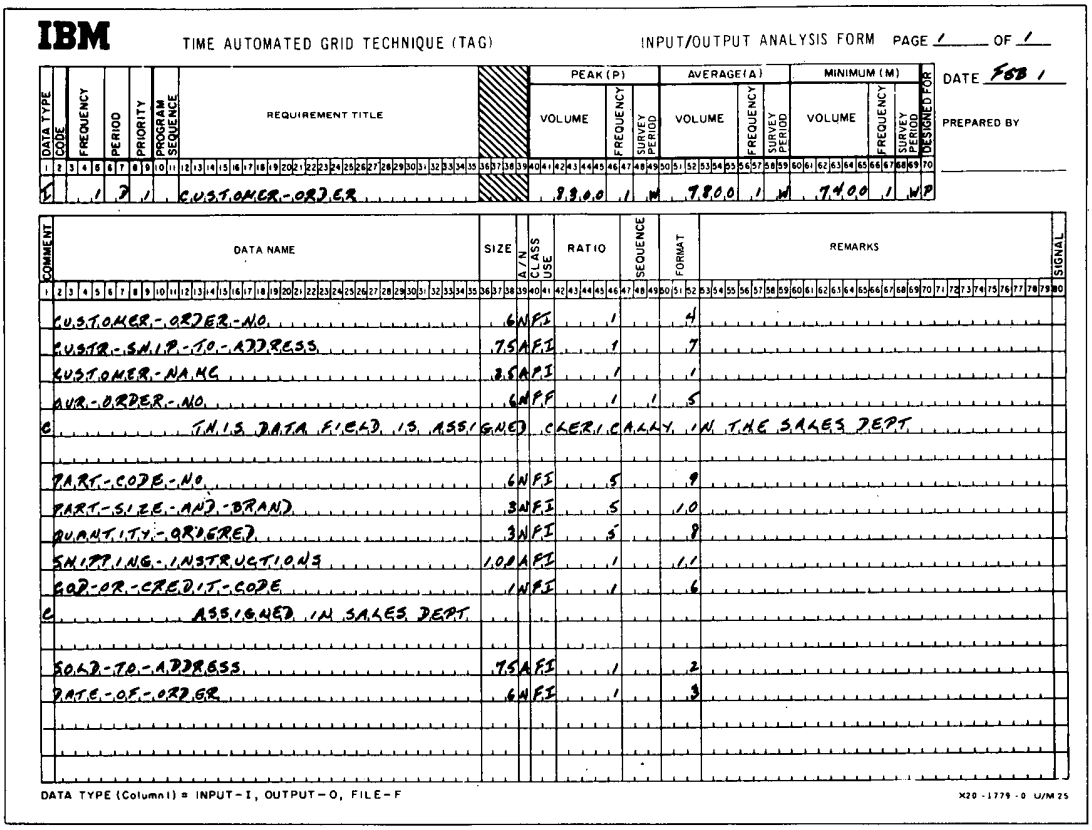
Since volume is such an important consideration in systems design, TAG requires the entry of additional information in the volume section of the I/O analysis form. Space is provided in columns 48-49, 58-59, and 68-69 to specify length of the survey period. In the case of the warehouse order, the three volumes were obtained by studying daily figures over a one-week period. Columns 46-47, 56-57, and 66-67 show that each of the recorded figures was reached once during the study.

It is recommended that comments on the volume figures be included on the I/O analysis sheet where necessary. In this way, the analyst who reviews the forms will have a better understanding of the validity and accuracy of the figures. In fact, the liberal use of comments throughout the data name portion of the form is important to later understanding of the data. If rules are established concerning the use of these comments, the analysis form becomes an excellent documentation tool.

By placing a C in column 1 of the data name portion of the form, the user indicates to TAG that columns 2-80 contain a comment. If column 1 is blank, columns 2-80 are assumed to contain information about the data requirements of the requirement title. In the case of output, data requirements include those that will appear in the output and those that will not appear but are necessary to produce the required output. Examples are control fields and factors in calculations.

Whenever a data name is described as a variable result, the user must list, as data requirements of the output, the factors that go into that result. TAG has no way of determining whether or not the factors necessary for a particular calculation have been inputted to the system. It is the user's responsibility to relate factors to results. One means of doing so is to include the formula for the calculation, as a comment, following the variable result to which it pertains. If, in addition, the formula is written in a programming language, it will be of use later in implementation of the design. (See comment following "quantity-out-of-stock", Figure 10.)

A data name should also be listed as an output requirement when it is a sequence element that orders the output documents but does not itself appear on the documents. When a data name is either a nonappearing sequence element or a factor in a calculation, the format entry (columns 50-52) for that data name should be left blank.



IBM TIME AUTOMATED GRID TECHNIQUE (TAG) INPUT/OUTPUT ANALYSIS FORM PAGE 1 OF 1

DATE FEB 1

PREPARED BY

DATA TYPE CODE	FREQUENCY	PERIOD	PRIORITY	PROGRAM SEQUENCE	REQUIREMENT TITLE	PEAK (P) VOLUME	PEAK (P) FREQUENCY	PEAK (P) SURVEY PERIOD	AVERAGE (A) VOLUME	AVERAGE (A) FREQUENCY	AVERAGE (A) SURVEY PERIOD	MINIMUM (M) VOLUME	MINIMUM (M) FREQUENCY	MINIMUM (M) SURVEY PERIOD	DESIGNED FOR
I	1	D	1		CUSTOMER-ORDER	8300	1	M	7800	1	M	7400	1	M	WP

COMMENT	DATA NAME	SIZE	A/N	CLASS USE	RATIO	SEQUENCE	FORMAT	REMARKS	SIGNAL
	CUSTOMER-ORDER-NO.	6	N	FI	1		4		
	CUSTR-SHIP-TO-ADDRESS	75	A	FI	1		7		
	CUSTOMER-NAME	25	A	FI	1		1		
	OUR-ORDER-NO.	6	N	FF	1	1	5		
C	THIS DATA FIELD IS ASSIGNED CLERICALLY IN THE SALES DEPT								
	PART-CODE-NO.	6	N	FI	5		9		
	PART-SIZE-AND-BRAND	3	N	FI	5		10		
	QUANTITY-ORDERED	3	N	FI	5		8		
	SHIPPING-INSTRUCTIONS	100	A	FI	1		11		
	DOR-OR-CREDIT-CODE	1	N	FI	1		6		
C	ASSIGNED IN SALES DEPT.								
	SOLD-TO-ADDRESS	75	A	FI	1		2		
	DATE-OF-ORDER	6	N	FI	1		3		

DATA TYPE (Column1) = INPUT-I, OUTPUT-O, FILE-F

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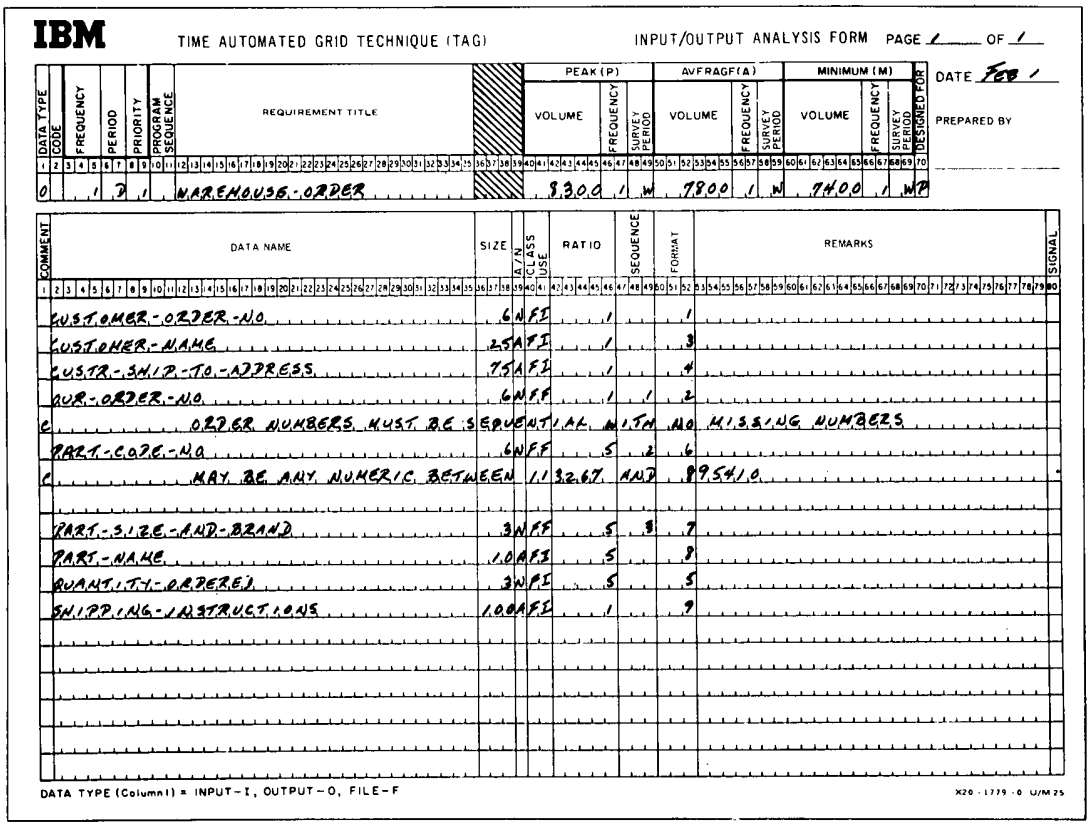
Figure 8. I/O analysis form for the customer order



IBM TIME AUTOMATED GRID TECHNIQUE (TAG) INPUT/OUTPUT ANALYSIS FORM PAGE 1 OF 1

DATE FEB 1

PREPARED BY

DATA TYPE CODE	FREQUENCY	PERIOD	PRIORITY	PROGRAM SEQUENCE	REQUIREMENT TITLE	PEAK (P) VOLUME	PEAK (P) FREQUENCY	PEAK (P) SURVEY PERIOD	AVERAGE (A) VOLUME	AVERAGE (A) FREQUENCY	AVERAGE (A) SURVEY PERIOD	MINIMUM (M) VOLUME	MINIMUM (M) FREQUENCY	MINIMUM (M) SURVEY PERIOD	DESIGNED FOR
O	1	D	1		WAREHOUSE-ORDER	8300	1	M	7800	1	M	7400	1	M	WP

COMMENT	DATA NAME	SIZE	A/N	CLASS USE	RATIO	SEQUENCE	FORMAT	REMARKS	SIGNAL
	CUSTOMER-ORDER-NO.	6	N	FI	1		1		
	CUSTOMER-NAME	25	A	FI	1		3		
	CUSTR-SHIP-TO-ADDRESS	75	A	FI	1		4		
	OUR-ORDER-NO.	6	N	FF	1	1	2		
C	ORDER NUMBERS MUST BE SEQUENTIAL WITH NO MISSING NUMBERS								
	PART-CODE-NO	6	N	FF	5	2	6		
C	MAY BE ANY NUMERIC BETWEEN 1 AND 999999								
	PART-SIZE-AND-BRAND	3	N	FF	5	3	7		
	PART-NAME	10	A	FI	5		8		
	QUANTITY-ORDERED	3	N	FI	5		5		
	SHIPPING-INSTRUCTIONS	100	A	FI	1		9		

DATA TYPE (Column1) = INPUT-I, OUTPUT-O, FILE-F

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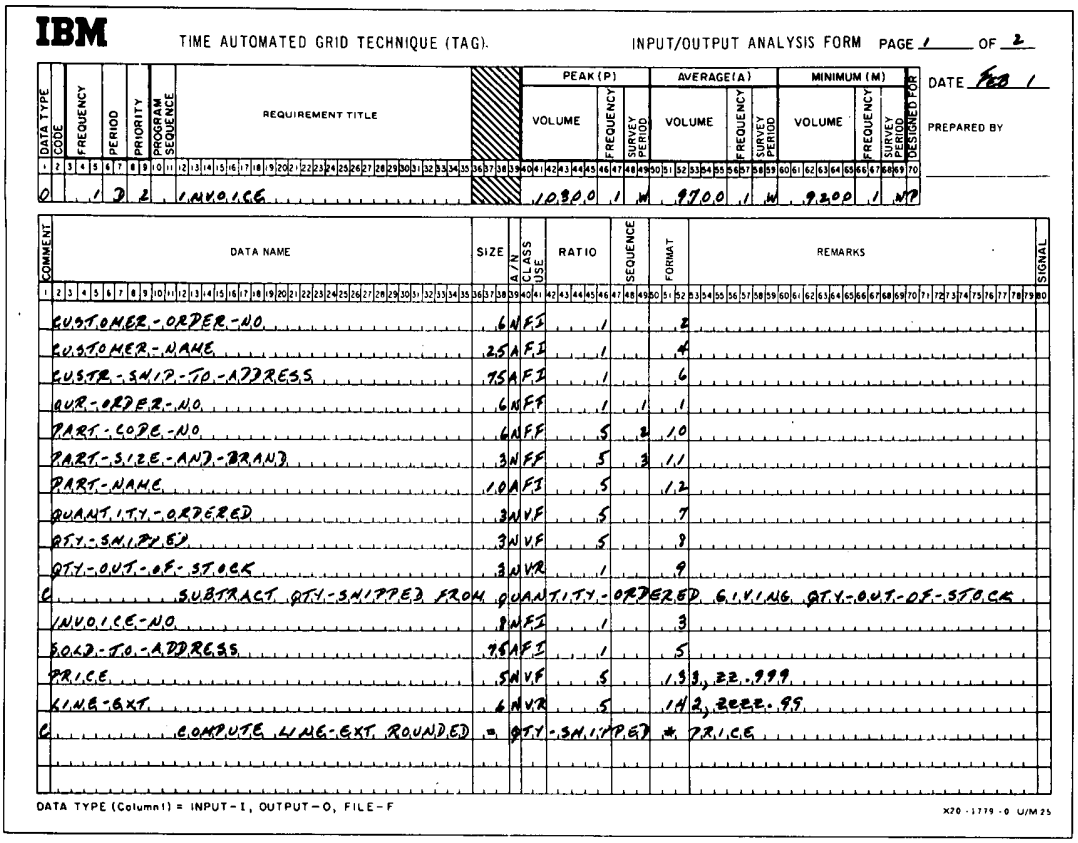
Figure 9. I/O analysis form for the warehouse order



IBM TIME AUTOMATED GRID TECHNIQUE (TAG). INPUT/OUTPUT ANALYSIS FORM PAGE 1 OF 2

DATE FEB 1

PREPARED BY

DESIGNED FOR

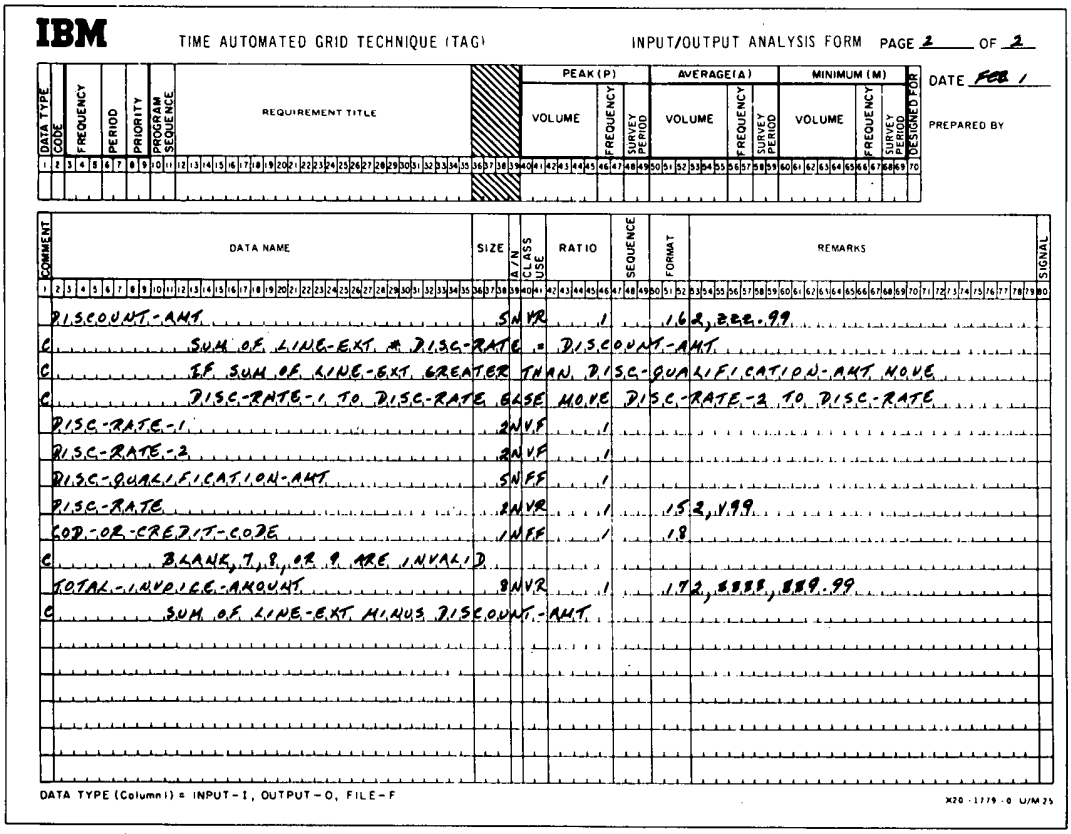
DATA TYPE	CODE	FREQUENCY	PERIOD	PRIORITY	PROGRAM SEQUENCE	REQUIREMENT TITLE	PEAK (P) VOLUME	PEAK (P) FREQUENCY	PEAK (P) SURVEY PERIOD	AVERAGE (A) VOLUME	AVERAGE (A) FREQUENCY	AVERAGE (A) SURVEY PERIOD	MINIMUM (M) VOLUME	MINIMUM (M) FREQUENCY	MINIMUM (M) SURVEY PERIOD
O		1	D	2		INVOICE	10,800.0	1	W	9700.0	1	W	9200	1	W

COMMENT	DATA NAME	SIZE	A/N CLASS USE	RATIO	SEQUENCE	FORMAT	REMARKS	SIGNAL
	CUSTOMER-ORDER-NO	6	N F I	1		2		
	CUSTOMER-NAME	25	A F I	1		4		
	CUSTR-SHIP-TO-ADDRESS	75	A F I	1		6		
	OUR-ORDER-NO	6	N F F	1	1	1		
	PART-CODE-NO	6	N F F	5	2	10		
	PART-SIZE-AND-BRAND	3	N F F	5	3	11		
	PART-NAME	10	A F I	5		12		
	QUANTITY-ORDERED	3	N V F	5		7		
	QTY-SHIPPED	3	N V F	5		8		
	QTY-OUT-OF-STOCK	3	N V R	1		9		
C	SUBTRACT QTY-SHIPPED FROM QUANTITY-ORDERED GIVING QTY-OUT-OF-STOCK							
	INVOICE-NO	8	N F I	1		3		
	SOLD-TO-ADDRESS	75	A F I	1		5		
	PRICE	5	N V F	5		13	9,99.999	
	LINE-EXT	6	N V R	5		14	2,222.99	
C	COMPUTE LINE-EXT ROUNDED = QTY-SHIPPED * PRICE							

DATA TYPE (Column 1) = INPUT-I, OUTPUT-O, FILE-F

X20-1779-0 U/M 25

Figure 10. I/O analysis form for the invoice



IBM TIME AUTOMATED GRID TECHNIQUE (TAG) INPUT/OUTPUT ANALYSIS FORM PAGE 2 OF 2

DATE FEB 1

PREPARED BY

DESIGNED FOR

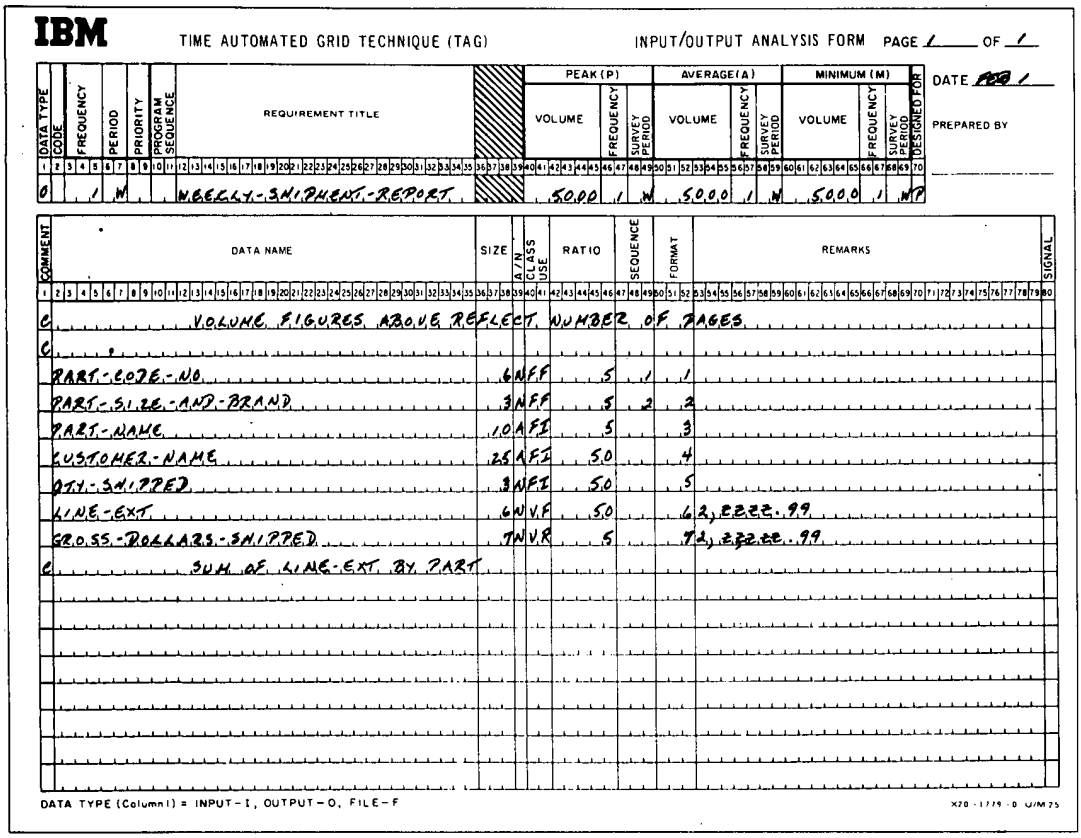
DATA TYPE	CODE	FREQUENCY	PERIOD	PRIORITY	PROGRAM SEQUENCE	REQUIREMENT TITLE	PEAK (P) VOLUME	PEAK (P) FREQUENCY	PEAK (P) SURVEY PERIOD	AVERAGE (A) VOLUME	AVERAGE (A) FREQUENCY	AVERAGE (A) SURVEY PERIOD	MINIMUM (M) VOLUME	MINIMUM (M) FREQUENCY	MINIMUM (M) SURVEY PERIOD

COMMENT	DATA NAME	SIZE	A/N CLASS USE	RATIO	SEQUENCE	FORMAT	REMARKS	SIGNAL
	DISCOUNT-AMT	5	N V R	1		16	2,222.99	
C	SUM OF LINE-EXT * DISC-RATE = DISCOUNT-AMT							
C	IF SUM OF LINE-EXT GREATER THAN DISC-QUALIFICATION-AMT MOVE							
C	DISC-RATE-1 TO DISC-RATE ELSE MOVE DISC-RATE-2 TO DISC-RATE							
	DISC-RATE-1	2	N V F	1				
	DISC-RATE-2	2	N V F	1				
	DISC-QUALIFICATION-AMT	5	N F F	1				
	DISC-RATE	2	N V R	1		15	2,V99	
	COD-OR-CREDIT-CODE	1	N F F	1		18		
C	BLANK, 7, 8, OR 9 ARE INVALID							
	TOTAL-INVOICE-AMOUNT	8	N V R	1		17	2,888,889.99	
C	SUM OF LINE-EXT MINUS DISCOUNT-AMT							

DATA TYPE (Column 1) = INPUT-I, OUTPUT-O, FILE-F

X20-1779-0 U/M 25

Figure 11. I/O analysis form for the invoice (continued)



IBM TIME AUTOMATED GRID TECHNIQUE (TAG) INPUT/OUTPUT ANALYSIS FORM PAGE 1 OF 1

DATE 8/8/1 PREPARED BY

DATA TYPE	CODE	FREQUENCY	PERIOD	PRIORITY	PROGRAM SEQUENCE	REQUIREMENT TITLE	PEAK (P) VOLUME	PEAK (P) FREQUENCY	PEAK (P) SURVEY PERIOD	AVERAGE (A) VOLUME	AVERAGE (A) FREQUENCY	AVERAGE (A) SURVEY PERIOD	MINIMUM (M) VOLUME	MINIMUM (M) FREQUENCY	MINIMUM (M) SURVEY PERIOD	DESIGNED FOR
O		1	W			WEEKLY-SHIPMENT-REPORT	50.00	1	W	50.00	1	W	50.00	1	W	MP

COMMENT	DATA NAME	SIZE	A/N	CLASS USE	RATIO	SEQUENCE	FORMAT	REMARKS	SIGNAL
C	VOLUME FIGURES ABOVE REFLECT NUMBER OF PAGES								
C									
	PART-CODE-NO	6	N	F F	5	1	1		
	PART-SIZE-AND-BRAND	3	N	F F	5	2	2		
	PART-NAME	10	A	F I	5		3		
	CUSTOMER-NAME	25	A	F I	5.0		4		
	QTY-SHIPPED	3	N	F I	5.0		5		
	LINE-EXT	6	N	V F	5.0		6	2,222.99	
	GROSS-DOLLARS-SHIPPED	7	N	V R	5		7	2,222.99	
C	SUM OF LINE-EXT BY PART								

DATA TYPE (Column 1) = INPUT-I, OUTPUT-O, FILE-F

X20-1779-0 U/M 25

Figure 12. I/O analysis form for the weekly shipment report

TAG REPORTS – FIRST PASS OF DATA

The first report produced by TAG is a listing of user's data (Figure 13). Note the entry number, assigned by TAG, which appears on each title line between the requirement title and the peak volume.

Once cycle and header numbers have been associated with each requirement title analyzed (for a detailed description of the process, see introductory section on TAG reports), Report 3, the document analysis, is created. The document analysis (Figure 15) is in header-number sequence with a cross-reference to entry number. It describes the size of the system study in terms of documents, their volume, and the characters contained in them.

```
O    1 D 1   WAREHOUSE-ORDER                1   8300 1 W   7800 1 W   7400 1 WP
             CUSTOMER-ORDER-NO             6NFI      1        1
             CUSTOMER-NAME                25AFI      1        3
             CUSTR-SHIP-TO-ADDRESS        75AFI      1        4
             OUR-ORDER-NO                  6NFF      1   1    2
C              ORDER NUMBERS MUST BE SEQUENTIAL WITH NO MISSING NUMBERS
             PART-CODE-NO                  6NFF      5   2    6
C              MAY BE ANY NUMERIC BETWEEN 113267 AND 895410
             PART-SIZE-AND-BRAND           3NFF      5   3    7
             PART-NAME                    10AFI      5        8
             QUANTITY-ORDERED              3NFI      5        5
             SHIPPING-INSTRUCTIONS       100AFI      1        9


O    1 D 2   INVOICE                       2  10300 1 W   9700 1 W   9200 1 WP
             CUSTOMER-ORDER-NO             6NFI      1        2
             CUSTOMER-NAME                25AFI      1        4
             CUSTR-SHIP-TO-ADDRESS        75AFI      1        6
             OUR-ORDER-NO                  6NFF      1   1    1
             PART-CODE-NO                  6NFF      5   2   10
             PART-SIZE-AND-BRAND           3NFF      5   3   11
             PART-NAME                    10AFI      5       12
             QUANTITY-ORDERED              3NVF      5        7
             QTY-SHIPPED                   3NVF      5        8
             QTY-OUT-OF-STOCK              3NVR      1        9
C              SUBTRACT QTY-SHIPPED FROM QUANTITY-ORDERED GIVING QTY-OUT-OF-STOCK
             INVOICE-NO                    8NFI      1        3
             SOLD-TO-ADDRESS              75AFI      1        5
             PRICE                         5NVF      5     133,ZZ.999
             LINE-EXT                      6NVR      5     142,ZZZZ.99
C              COMPUTE LINE-EXT ROUNDED = QTY-SHIPPED * PRICE
             DISCOUNT-AMT                  5NVR      1     162,ZZZ.99
C              *SUM OF LINE-EXT * DISC-RATE = DISCOUNT-AMT
             DISC-RATE                     2NVR      1     152,V99
C              IF SUM OF LINE-EXT GREATER THAN DISC-QUALIFICATION-AMT MOVE
C              DISC-RATE-1 TO DISC-RATE ELSE MOVE DISC-RATE-2 TO DISC-RATE
             DISC-RATE-1                   2NVF      1
             DISC-RATE-2                   2NVF      1
             DISC-QUALIFICATION-AMT        5NFF      1
             COD-OR-CREDIT-CODE            1NFF      1     18
C              BLANK,7,8,OR 9 ARE INVALID
             TOTAL-INVOICE-AMOUNT          8NVR      1     172,$$$$,$$9.99
C              SUM OF LINE-EXT MINUS DISCOUNT-AMT


I    1 D 1   CUSTOMER-ORDER                3   8300 1 W   7800 1 W   7400 1 WP
             CUSTOMER-ORDER-NO             6NFI      1        4
             CUSTR-SHIP-TO-ADDRESS        75AFI      1        7
             CUSTOMER-NAME                25AFI      1        1
             OUR-ORDER-NO                  6NFF      1   1    5
C              THIS DATA FIELD IS ASSIGNED CLERICALLY IN THE SALES DEPT
             PART-CODE-NO                  6NFI      5        9
             PART-SIZE-AND-BRAND           3NFI      5       10
             QUANTITY-ORDERED              3NFI      5        8
             SHIPPING-INSTRUCTIONS       100AFI      1       11
             COD-OR-CREDIT-CODE            1NFI      1        6
C              ASSIGNED IN SALES DEPT
             SOLD-TO-ADDRESS              75AFI      1        2
             DATE-OF-ORDER                 6NFI      1        3
```

Figure 13. Listing of users data

```
O   1 W     WEEKLY-SHIPMENT-REPORT      4  5000 1 W  5000 1 W  5000 1 WP
C           VOLUME FIGURES ABOVE REFLECT NUMBER OF PAGES
C
            PART-CODE-NO                6NFF    5  1  1
            PART-SIZE-AND-BRAND         3NFF    5  2  2
            PART-NAME                  10AFI    5     3
            CUSTOMER-NAME              25AFI   50     4
            QTY-SHIPPED                 3NFI   50     5
            LINE-EXT                    6NVF   50     62,ZZZ.99
            GROSS-DOLLARS-SHIPPED       7NVR    5     72,Z,ZZZ.99
C             SUM OF LINE-EXT BY PART
```

Figure 14. Listing of users data (continued)

```
   RESULTS OF ANALYSIS BY TIME-GRID TECHNIQUE



   4 HEADERS,   1 INPUTS,   3 OUTPUTS.


HEADER NO. I/O ANALYSIS NO. HEADER NAME              CYCLE TYPE VOLUME NUM.CHAR. ALPHA CHAR.
         1                3 CUSTOMER-ORDER           1  I     8300        79         275
         2                1 WAREHOUSE-ORDER          1  O     8300        72         250
         3                2 INVOICE                  2  O    10300       178         225
         4                4 WEEKLY-SHIPMENT-REPORT   3  O     5000       530        1300
```

Figure 15. Document analysis

Figures 16 and 17 of the sample problem show Reports 4 and 5, a sorted list of data requirements and a time-grid for the first 20 data names in the system. There may be multiple pages of these reports, depending on the quantity of data. Each usage of a data name appears as it was originally recorded on the I/O analysis form. The cycle, the header number, and the header type for which the data name is required appear with it. For example, "COD-or-credit-code" is used in header 1, which is an input in cycle 1, and in header 3, which is an output of cycle 2.

To produce Report 5, TAG reduces the sorted list to unique data elements and assigns a reference (data) number to each. These numbers are printed across the page, and the header numbers, in sequence by time, are printed down the left side of the page. The numbers appearing within the grid are the ratio figures from columns 42-46 of the I/O analysis sheet. In the sample problem, data element 13 ("line-ext") does not appear on the customer order or warehouse order; appears 5 times on the invoice; and appears 50 times per page on the weekly shipment report.

RESULTS OF ANALYSIS BY TIME-GRID TECHNIQUE

CYCLE	NO&TP	NAME	SZE	CL	RAT	SEQ	FOR	COMMENTS	
1	1I	COD-OR-CREDIT-CODE	1NFI	1	9	6			0
2	30	COD-OR-CREDIT-CODE	1NFF	1	9	18			0
1	1I	CUSTOMER-NAME	25AFI	1	9	1			0
1	20	CUSTOMER-NAME	25AFI	1	9	3			0
2	30	CUSTOMER-NAME	25AFI	1	9	4			0
3	40	CUSTOMER-NAME	25AFI	50	9	4			0
1	1I	CUSTOMER-ORDER-NO	6NFI	1	9	4			0
1	20	CUSTOMER-ORDER-NO	6NFI	1	9	1			0
2	30	CUSTOMER-ORDER-NO	6NFI	1	9	2			0
1	1I	CUSTR-SHIP-TO-ADDRESS	75AFI	1	9	7			0
1	20	CUSTR-SHIP-TO-ADDRESS	75AFI	1	9	4			0
2	30	CUSTR-SHIP-TO-ADDRESS	75AFI	1	9	6			0
1	1I	DATE-OF-ORDER	6NFI	1	9	3			0
2	30	DISC-QUALIFICATION-AMT	5NFF	1	9	0			0
2	30	DISC-RATE	2NVR	1	9	152		V99	0
2	30	DISC-RATE-1	2NVF	1	9	0			0
2	30	DISC-RATE-2	2NVF	1	9	0			0
2	30	DISCOUNT-AMT	5NVR	1	9	162		ZZZ.99	0
3	40	GROSS-DOLLARS-SHIPPED	7NVR	5	9	72		Z,ZZZ.99	0
2	30	INVOICE-NO	8NFI	1	9	3			0
2	30	LINE-EXT	6NVR	5	9	142		ZZZZ.99	0
3	40	LINE-EXT	6NVF	50	9	62		ZZZZ.99	0
1	1I	OUR-ORDER-NO	6NFF	1	1	5			0
1	20	OUR-ORDER-NO	6NFF	1	1	2			0
2	30	OUR-ORDER-NO	6NFF	1	1	1			0
1	1I	PART-CODE-NO	6NFI	5	9	9			0
1	20	PART-CODE-NO	6NFF	5	2	6			0
2	30	PART-CODE-NO	6NFF	5	2	10			0
3	40	PART-CODE-NO	6NFF	5	1	1			0
1	20	PART-NAME	10AFI	5	9	8			0
2	30	PART-NAME	10AFI	5	9	12			0
3	40	PART-NAME	10AFI	5	9	3			0
1	1I	PART-SIZE-AND-BRAND	3NFI	5	9	10			0
1	20	PART-SIZE-AND-BRAND	3NFF	5	3	7			0
2	30	PART-SIZE-AND-BRAND	3NFF	5	3	11			0
3	40	PART-SIZE-AND-BRAND	3NFF	5	2	2			0
2	30	PRICE	5NVF	5	9	133		ZZ.999	0
2	30	QTY-OUT-OF-STOCK	3NVR	1	9	9			0
2	30	QTY-SHIPPED	3NVF	5	9	8			0
3	40	QTY-SHIPPED	3NFI	50	9	5			0

Figure 16. Sorted list of data requirements

```
   RESULTS OF ANALYSIS BY TIME-GRID TECHNIQUE



DATA                                          DATA
NUMBER DATA NAME                  SIZE A/N USE  NUMBER DATA NAME                  SIZE A/N USE
     1 COD-OR-CREDIT-CODE            1 N   FI        2 CUSTOMER-NAME              25 A   FI
     3 CUSTOMER-ORDER-NO             6 N   FI        4 CUSTR-SHIP-TO-ADDRESS      75 A   FI
     5 DATE-OF-ORDER                 6 N   FI        6 DISC-QUALIFICATION-AMT      5 N   FF
     7 DISC-RATE                     2 N   VR        8 DISC-RATE-1                 2 N   VF
     9 DISC-RATE-2                   2 N   VF       10 DISCOUNT-AMT                5 N   VR
    11 GROSS-DOLLARS-SHIPPED         7 N   VR       12 INVOICE-NO                  8 N   FI
    13 LINE-EXT                      6 N   VR       14 OUR-ORDER-NO                6 N   FF
    15 PART-CODE-NO                  6 N   FI       16 PART-NAME                  10 A   FI
    17 PART-SIZE-AND-BRAND           3 N   FI       18 PRICE                       5 N   VF
    19 QTY-OUT-OF-STOCK              3 N   VR       20 QTY-SHIPPED                 3 N   VF


DATA NUMBER                      1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19  20

CYCLE

  1 CUSTOMER-ORDER               1   1   1   1   1   0   0   0   0   0   0   0   0   1   5   0   5   0   0   0
    (    1) 8300...  1 X D
  1 WAREHOUSE-ORDER              0   1   1   1   0   0   0   0   0   0   0   0   0   1   5   5   5   0   0   0
    (    2) 8300...  1 X D
  2 INVOICE                      1   1   1   1   0   1   1   1   1   1   0   1   5   1   5   5   5   5   1   5
    (    3)10300...  1 X D
  3 WEEKLY-SHIPMENT-REPORT       0  50   0   0   0   0   0   0   0   0   5   0  50   0   5   5   5   0   0  50
    (    4) 5000...  1 X W

SUMMARY CODES                    1  15   1   1   4   3   2   3   3   2   2   3 152   1   1  13   1   3   2 153


MEANING OF SUMMARY CODES

0 - RATIO OF INPUT = RATIO OF OUTPUT, INPUT AVAILABLE AT TIME OF OUTPUT
1 - PLURAL CYCLES - FILES
2 - SYSTEM GENERATED (VARIABLE RESULT)
3 - NO INPUT BUT OUTPUT, NOT VARIABLE RESULT
4 - NO OUTPUT BUT INPUT
5 - RATIOS NOT EQUAL
6 - OUTPUT REQUIRED BEFORE INPUT IS AVAILABLE
```

Figure 17. Time-grid of data names

Figures 18 and 19 are continuations of the sorted list and grid. Note that Figure 19 shows only three headers instead of four. The fourth header name has been omitted because it does not contain any of the data elements shown in this portion of the grid.

On each grid, following the last header analyzed, is a line of summary codes – one or more for each data element in the grid. Below the codes is their legend.

The final reports in Pass 1 are a summary of unresolved conditions and a time/key analysis – a listing of all headers showing their time and sequence requirements. (Figures 20 and 21).

```
  RESULTS OF ANALYSIS BY TIME-GRID TECHNIQUE


CYCLE NO&TP NAME                      SIZE CL RAT SEQFORCOMMENTS
      1   1IQUANTITY-ORDERED           3NFI   5  9  8                          0
      1   2OQUANTITY-ORDERED           3NFI   5  9  5                          0
      2   3OQUANTITY-ORDERED           3NVF   5  9  7                          0
      1   1ISHIPPING-INSTRUCTIONS    100AFI   1  9 11                          0
      1   2OSHIPPING-INSTRUCTIONS    100AFI   1  9  9                          0
      1   1ISOLD-TO-ADDRESS           75AFI   1  9  2                          0
      2   3OSOLD-TO-ADDRESS           75AFI   1  9  5                          0
      2   3OTOTAL-INVOICE-AMOUNT       8NVR   1  9 172,$$$$,$$9.99             0
```

Figure 18. Continuation of the sorted list of data requirements

```
   RESULTS OF ANALYSIS BY TIME-GRID TECHNIQUE



DATA                                                    DATA
NUMBER DATA NAME                  SIZE A/N USE          NUMBER DATA NAME                  SIZE A/N USE
    21 QUANTITY-ORDERED              3 N   FI               22 SHIPPING-INSTRUCTIONS      100 A   FI
    23 SOLD-TO-ADDRESS              75 A   FI               24 TOTAL-INVOICE-AMOUNT         8 N   VR


DATA NUMBER                        21   22   23   24

CYCLE


  1 CUSTOMER-ORDER                  5    1    1    0
    (    1) 8300...  1 X D
  1 WAREHOUSE-ORDER                 5    1    0    0
    (    2) 8300...  1 X D
  2 INVOICE                         5    0    1    1
    (    3)10300...  1 X D

SUMMARY CODES                       1    0    1    2


MEANING OF SUMMARY CODES

0 - RATIO OF INPUT = RATIO OF OUTPUT, INPUT AVAILABLE AT TIME OF OUTPUT
1 - PLURAL CYCLES - FILES
2 - SYSTEM GENERATED (VARIABLE RESULT)
3 - NO INPUT BUT OUTPUT, NOT VARIABLE RESULT
4 - NO OUTPUT BUT INPUT
5 - RATIOS NOT EQUAL
6 - OUTPUT REQUIRED BEFORE INPUT IS AVAILABLE
```

Figure 19. Continuation of the time-grid

DATA NO.	DATA NAME	CODE	PAGE NO.
2	CUSTOMER-NAME	15	3
5	DATE-OF-ORDER	4	3
6	DISC-QUALIFICATION-AMT	3	3
8	DISC-RATE-1	3	3
9	DISC-RATE-2	3	3
12	INVOICE-NO	3	3
13	LINE-EXT	152	3
16	PART-NAME	13	3
18	PRICE	3	3
20	QTY-SHIPPED	153	3

Figure 20. Summary of unresolved conditions

```
 1      1 I  CUSTOMER-ORDER                    8300
                          14   0    0    0    0    0    0    0
 1      2 O  WAREHOUSE-ORDER                   8300
                          14  15   17    0    0    0    0    0
 2      3 O  INVOICE                          10300
                          14  15   17    0    0    0    0    0
 3      4 O  WEEKLY-SHIPMENT-REPORT            5000
                          15  17    0    0    0    0    0    0
```

Figure 21. Time/key analysis

ANALYSIS OF UNRESOLVED CONDITIONS

When analyzing unresolved conditions, the reviewer should examine more than just those data names that appear on the summary. For example, data elements 16 ("part-name") and 18 ("price") appear on the summary with a code of 3- "no input but output, not variable result". In the sample problem, a reference file containing these elements is introduced. Note, however, that a file containing only part names and prices is of no value, since no means of accessing the proper record is provided. Therefore, an investigation of what else is to appear in the reference file must be made.

The sample problem shows (Figure 17) that "part-name" is required for the first time in cycle 1 by the warehouse order. The warehouse order, then, is checked for data elements coded as FF, because these are the elements that can most often be used to relate outputs to files and files to files. It becomes obvious that "part-code-number" and "part-size-and-brand" must be included on the reference file if "part-name" and "price" are to be accessed correctly.

The reference file itself must be introduced into the system in cycle 1 since the warehouse order is produced in cycle 1. This is done by assigning to the parts reference file the same frequency, period, and priority that appear for the warehouse order. Figure 9 illustrates the I/O analysis form for the warehouse order and Figure 22 illustrates the I/O analysis form for the parts reference file.

Similar logic is used to determine what must be included on the warehouse ticket (Figure 23) in cycle 2 in order to resolve summary code 3 for data element 20, "qty. – shipped". (See Figure 17). Corrections to and constants used in the documents in files are shown in Figure 24.

IBM TIME AUTOMATED GRID TECHNIQUE (TAG) INPUT/OUTPUT ANALYSIS FORM PAGE 1 OF 1

DATE FEB 8

PREPARED BY

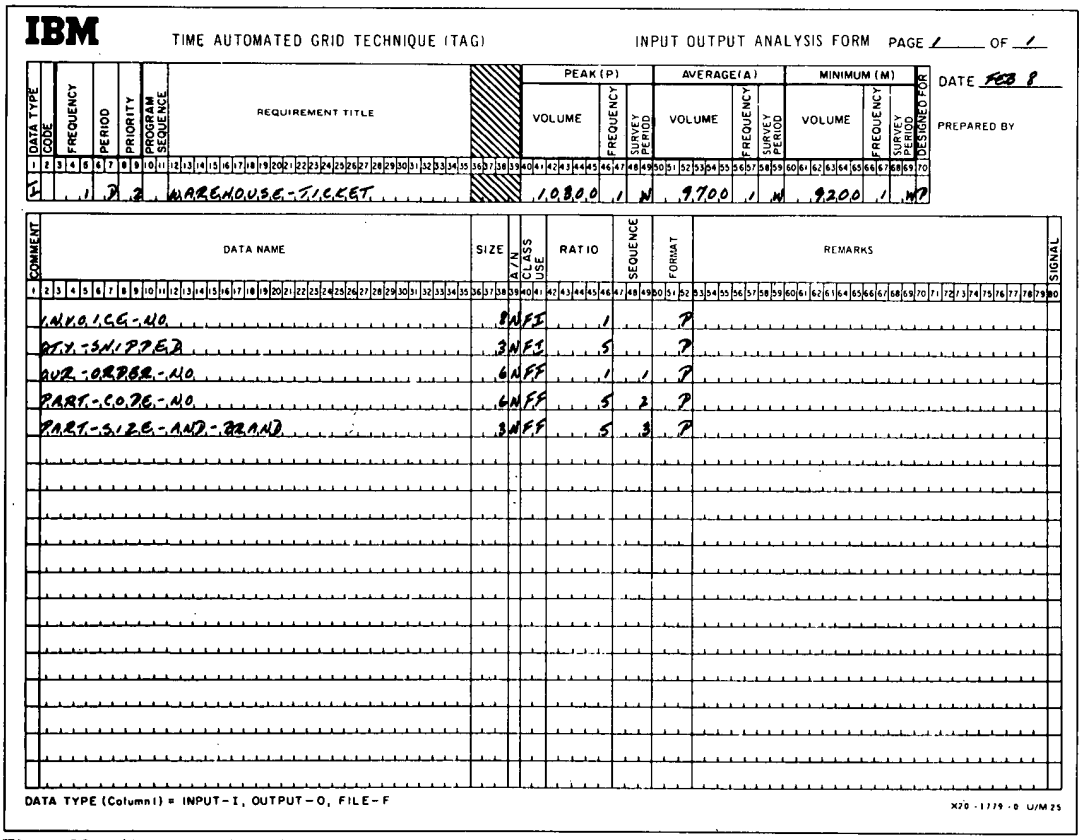
DATA TYPE	CODE	FREQUENCY	PERIOD	PRIORITY	PROGRAM SEQUENCE	REQUIREMENT TITLE	PEAK(P) VOLUME	PEAK(P) FREQUENCY	PEAK(P) SURVEY PERIOD	AVERAGE(A) VOLUME	AVERAGE(A) FREQUENCY	AVERAGE(A) SURVEY PERIOD	MINIMUM (M) VOLUME	MINIMUM (M) FREQUENCY	MINIMUM (M) SURVEY PERIOD	DESIGNED FOR
FR		1	D	1		PARTS-REFERENCE-FILE	25000	1	D	25000	1	D	25000	1	D	DP

COMMENT	DATA NAME	SIZE	A/N	CLASS USE	RATIO	SEQUENCE	FORMAT	REMARKS	SIGNAL
	PART-CODE-NO	6	N	FF		1	1	P	
	PART-SIZE-AND-BRAND	3	N	FF		1	2	P	
	PART-NAME	10	A	FI		1		P	
	PRICE	5	N	FF		1		P	

DATA TYPE (Column1) = INPUT-I, OUTPUT-O, FILE-F

X20-1779-0 U/M25

Figure 22. I/O analysis form for the parts reference file



IBM TIME AUTOMATED GRID TECHNIQUE (TAG) INPUT OUTPUT ANALYSIS FORM PAGE 1 OF 1

DATE FEB 8 PREPARED BY

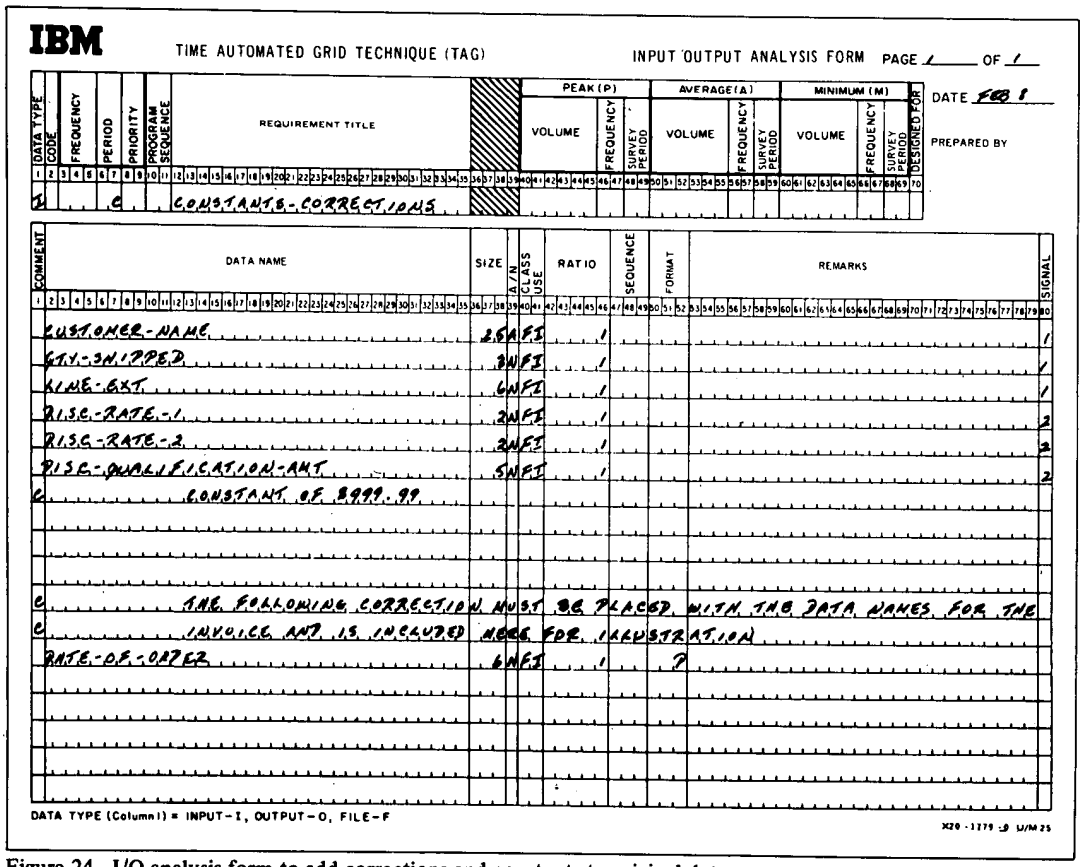
DATA TYPE	CODE	FREQUENCY	PERIOD	PRIORITY	PROGRAM SEQUENCE	REQUIREMENT TITLE	PEAK (P) VOLUME	PEAK (P) FREQUENCY	PEAK (P) SURVEY PERIOD	AVERAGE (A) VOLUME	AVERAGE (A) FREQUENCY	AVERAGE (A) SURVEY PERIOD	MINIMUM (M) VOLUME	MINIMUM (M) FREQUENCY	MINIMUM (M) SURVEY PERIOD	DESIGNED FOR
I			D	2		WAREHOUSE-TICKET	1080.0	1	N	970.0	1	N	920.0	1	N	MP

COMMENT	DATA NAME	SIZE	A/N CLASS USE	RATIO	SEQUENCE	FORMAT	REMARKS	SIGNAL
	INVOICE-NO	8	NFI	1		P		
	QTY-SHIPPED	3	NFI	5		P		
	OUR-ORDER-NO	6	NFF	1	1	P		
	PART-CODE-NO	6	NFF	5	2	P		
	PART-SIZE-AND-BRAND	3	NFF	5	3	P		

DATA TYPE (Column 1) = INPUT-I, OUTPUT-O, FILE-F

X20-1779-0 U/M 25

Figure 23. I/O analysis form for the warehouse ticket



IBM TIME AUTOMATED GRID TECHNIQUE (TAG) INPUT OUTPUT ANALYSIS FORM PAGE 1 OF 1

DATE FEB 8 PREPARED BY

DATA TYPE	CODE	FREQUENCY	PERIOD	PRIORITY	PROGRAM SEQUENCE	REQUIREMENT TITLE	PEAK (P) VOLUME	PEAK (P) FREQUENCY	PEAK (P) SURVEY PERIOD	AVERAGE (A) VOLUME	AVERAGE (A) FREQUENCY	AVERAGE (A) SURVEY PERIOD	MINIMUM (M) VOLUME	MINIMUM (M) FREQUENCY	MINIMUM (M) SURVEY PERIOD	DESIGNED FOR
H			C			CONSTANTS-CORRECTIONS										

COMMENT	DATA NAME	SIZE	A/N CLASS USE	RATIO	SEQUENCE	FORMAT	REMARKS	SIGNAL
	CUSTOMER-NAME	26	AFI	1				1
	QTY-SHIPPED	3	NFI	1				1
	LINE-EXT	6	NFI	1				1
	RISC-RATE-1	2	NFI	1				2
	RISC-RATE-2	2	NFI	1				2
	RISC-QUALIFICATION-AMT	5	NFI	1				2
C	CONSTANT OF $999.99							
C	THE FOLLOWING CORRECTION MUST BE PLACED WITH THE DATA NAMES FOR THE							
C	INVOICE AND IS INCLUDED NEED FOR ILLUSTRATION							
	RATE-OF-OTHER	6	NFI	1		P		

DATA TYPE (Column 1) = INPUT-I, OUTPUT-O, FILE-F

X20-1779-0 U/M 25

Figure 24. I/O analysis form to add corrections and constants to original data

TAG REPORTS – SECOND PASS OF DATA

After the user has reviewed the original TAG reports and has made corrections to the data, the corrections are keypunched, and the original data and corrections are re-entered into the system. The output will be as shown in Figures 25-33.

Figures 25-33 are similar to Figures 13-21, which were obtained on the first pass of the data. Note the indication at the bottom of Figure 26 that the user has modified a summary code. These modifications are also reflected in the summary codes in Figure 29, where a hyphen denotes a user-assigned code.

Addition of data elements may result in new unresolved conditions. In the sample problem, the inclusion of a parts reference file with a ratio of 1 for all data elements caused summary code 5 – "ratios not equal" – to be generated for all elements. In this case, variation in ratios was not an error, and it was not necessary to rerun TAG to correct the condition.

Once all conditions have been resolved, TAG defines files to communicate between the time periods in the system.

```
O   1 D 1  WAREHOUSE-ORDER              1  8300 1 W  7800 1 W  7400 1 WP
           CUSTOMER-ORDER-NO           6NFI     1      1
           CUSTOMER-NAME              25AFI     1      3
           CUSTR-SHIP-TO-ADDRESS      75AFI     1      4
           OUR-ORDER-NO                6NFF     1  1   2
C            ORDER NUMBERS MUST BE SEQUENTIAL WITH NO MISSING NUMBERS
           PART-CODE-NO                6NFF     5  2   6
C            MAY BE ANY NUMERIC BETWEEN 113267 AND 895410
           PART-SIZE-AND-BRAND         3NFF     5  3   7
           PART-NAME                  10AFI     5      8
           QUANTITY-ORDERED            3NFI     5      5
           SHIPPING-INSTRUCTIONS     100AFI     1      9


O   1 D 2  INVOICE                     2 10300 1 W  9700 1 W  9200 1 WP
           CUSTOMER-ORDER-NO           6NFI     1      2
           DATE-OF-ORDER               6NFI     1      P
           CUSTOMER-NAME              25AFI     1      4
           CUSTR-SHIP-TO-ADDRESS      75AFI     1      6
           OUR-ORDER-NO                6NFF     1  1   1
           PART-CODE-NO                6NFF     5  2  10
           PART-SIZE-AND-BRAND         3NFF     5  3  11
           PART-NAME                  10AFI     5     12
           QUANTITY-ORDERED            3NVF     5      7
           QTY-SHIPPED                 3NVF     5      8
           QTY-OUT-OF-STOCK            3NVR     1      9
C            SUBTRACT QTY-SHIPPED FROM QUANTITY-ORDERED GIVING QTY-OUT-OF-STOCK
           INVOICE-NO                  8NFI     1      3
           SOLD-TO-ADDRESS            75AFI     1      5
           PRICE                       5NVF     5    133,ZZ.999
           LINE-EXT                    6NVR     5    142,ZZZZ.99
C            COMPUTE LINE-EXT ROUNDED = QTY-SHIPPED * PRICE
           DISCOUNT-AMT                5NVR     1    162,ZZZ.99
C            SUM OF LINE-EXT * DISC-RATE = DISCOUNT-AMT
C            IF SUM OF LINE-EXT GREATER THAN DISC-QUALIFICATION-AMT MOVE
C            DISC-RATE-1 TO DISC-RATE ELSE MOVE DISC-RATE-2 TO DISC-RATE
           DISC-RATE-1                 2NVF     1
           DISC-RATE-2                 2NVF     1
           DISC-QUALIFICATION-AMT      5NFF     1
           DISC-RATE                   2NVR     1    152,V99
           COD-OR-CREDIT-CODE          1NFF     1     18
C            BLANK,7,8,OR 9 ARE INVALID
           TOTAL-INVOICE-AMOUNT        8NVR     1    172,$$$$,$$9.99
C            SUM OF LINE-EXT MINUS DISCOUNT-AMT


I   1 D 1  CUSTOMER-ORDER               3  8300 1 W  7800 1 W  7400 1 WP
           CUSTOMER-ORDER-NO           6NFI     1      4
           CUSTR-SHIP-TO-ADDRESS      75AFI     1      7
           CUSTOMER-NAME              25AFI     1      1
           OUR-ORDER-NO                6NFF     1  1   5
C            THIS DATA FIELD IS ASSIGNED CLERICALLY IN THE SALES DEPT
           PART-CODE-NO                6NFI     5      9
           PART-SIZE-AND-BRAND         3NFI     5     10
           QUANTITY-ORDERED            3NFI     5      6
           SHIPPING-INSTRUCTIONS     100AFI     1     11
           COD-OR-CREDIT-CODE          1NFI     1      6
C            ASSIGNED IN SALES DEPT
           SOLD-TO-ADDRESS            75AFI     1      2
```

Figure 25. Listing of user's data – second pass

```
            DATE-OF-ORDER              6NFI     1      3


O   1 W     WEEKLY-SHIPMENT-REPORT      4  5000 1 W  5000 1 W  5000 1 WP
C           VOLUME FIGURES ABOVE REFLECT NUMBER OF PAGES
C
            PART-CODE-NO               6NFF     5  1   1
            PART-SIZE-AND-BRAND        3NFF     5  2   2
            PART-NAME                 10AFI     5      3
            CUSTOMER-NAME             25AFI    50      4
            QTY-SHIPPED                3NFI    50      5
            LINE-EXT                   6NVF    50      62,ZZZZ.99
            GROSS-DOLLARS-SHIPPED      7NVR     5      72,Z,ZZZ.99
C             SUM OF LINE-EXT BY PART


FR  1 D 1   PARTS-REFERENCE-FILE        5 25000 1 D 25000 1 D 25000 1 DP
            PART-CODE-NO               6NFF     1  1   P
            PART-SIZE-AND-BRAND        3NFF     1  2   P
            PART-NAME                 10AFI     1      P
            PRICE                      5NFF     1      P


I   1 D 2   WAREHOUSE-TICKET            6 10300 1 W  9700 1 W  9200 1 WP
            INVOICE-NO                 8NFI     1      P
            QTY-SHIPPED                3NFI     5      P
            OUR-ORDER-NO               6NFF     1  1   P
            PART-CODE-NO               6NFF     5  2   P
            PART-SIZE-AND-BRAND        3NFF     5  3   P


I     C     CONSTANTS-CORRECTIONS       7
CARD BELOW  CONTAINS IN COLUMN 80 A MODIFICATION OF THE SUMMARY CODE.....
            CUSTOMER-NAME             25AFI     1                        1
CARD BELOW  CONTAINS IN COLUMN 80 A MODIFICATION OF THE SUMMARY CODE.....
            QTY-SHIPPED                3NFI     1                        1
CARD BELOW  CONTAINS IN COLUMN 80 A MODIFICATION OF THE SUMMARY CODE.....
            LINE-EXT                   6NFI     1                        1
CARD BELOW  CONTAINS IN COLUMN 80 A MODIFICATION OF THE SUMMARY CODE.....
            DISC-RATE-1                2NFI     1                        2
CARD BELOW  CONTAINS IN COLUMN 80 A MODIFICATION OF THE SUMMARY CODE.....
            DISC-RATE-2                2NFI     1                        2
CARD BELOW  CONTAINS IN COLUMN 80 A MODIFICATION OF THE SUMMARY CODE.....
            DISC-QUALIFICATION-AMT     5NFI     1                        2
C             CONSTANT OF $999.99
```

Figure 26. Continuation of listing of user's data – second pass

```
   RESULTS OF ANALYSIS BY TIME-GRID TECHNIQUE



   7 HEADERS,   3 INPUTS,   3 OUTPUTS.


HEADER NO. I/O ANALYSIS NO. HEADER NAME              CYCLE TYPE VOLUME NUM.CHAR. ALPHA CHAR.
         1                 7 CONSTANTS-CORRECTIONS     0 I        0        18         25
         2                 3 CUSTOMER-ORDER            1 I     8300        79        275
         3                 5 PARTS-REFERENCE-FILE      1 K    25000        14         10
         4                 1 WAREHOUSE-ORDER           1 O     8300        72        250
         5                 6 WAREHOUSE-TICKET          2 I    10300        74          0
         6                 2 INVOICE                   2 O    10300       184        225
         7                 4 WEEKLY-SHIPMENT-REPORT    3 O     5000       530       1300
```

Figure 27. Document analysis – second pass

RESULTS OF ANALYSIS BY TIME-GRID TECHNIQUE

CYCLE	NO&TP	NAME	SZE	CL	RAT	SEQ	FOR	COMMENTS	
1	2I	COD-OR-CREDIT-CODE	1NFI	1	9	6			0
2	6O	COD-OR-CREDIT-CODE	1NFF	1	9	18			0
1	2I	CUSTOMER-NAME	25AFI	1	9	1			0
1	4O	CUSTOMER-NAME	25AFI	1	9	3			0
2	6O	CUSTOMER-NAME	25AFI	1	9	4			0
3	7O	CUSTOMER-NAME	25AFI	50	9	4			0
1	2I	CUSTOMER-ORDER-NO	6NFI	1	9	4			0
1	4O	CUSTOMER-ORDER-NO	6NFI	1	9	1			0
2	6O	CUSTOMER-ORDER-NO	6NFI	1	9	2			0
1	2I	CUSTR-SHIP-TO-ADDRESS	75AFI	1	9	7			0
1	4O	CUSTR-SHIP-TO-ADDRESS	75AFI	1	9	4			0
2	6O	CUSTR-SHIP-TO-ADDRESS	75AFI	1	9	6			0
1	2I	DATE-OF-ORDER	6NFI	1	9	3			0
2	6O	DATE-OF-ORDER	6NFI	1	9999				0
2	6O	DISC-QUALIFICATION-AMT	5NFF	1	9	0			0
2	6O	DISC-RATE	2NVR	1	9	152,	V99		0
2	6O	DISC-RATE-1	2NVF	1	9	0			0
2	6O	DISC-RATE-2	2NVF	1	9	0			0
2	6O	DISCOUNT-AMT	5NVR	1	9	162,	ZZZ.99		0
3	7O	GROSS-DOLLARS-SHIPPED	7NVR	5	9	72,	Z,ZZZ.99		0
2	5I	INVOICE-NO	8NFI	1	9999				0
2	6O	INVOICE-NO	8NFI	1	9	3			0
2	6O	LINE-EXT	6NVR	5	9	142,	ZZZZ.99		0
3	7O	LINE-EXT	6NVF	50	9	62,	ZZZZ.99		0
1	2I	OUR-ORDER-NO	6NFF	1	1	5			0
1	4O	OUR-ORDER-NO	6NFF	1	1	2			0
2	5I	OUR-ORDER-NO	6NFF	1	1999				0
2	6O	OUR-ORDER-NO	6NFF	1	1	1			0
1	2I	PART-CODE-NO	6NFI	5	9	9			0
1	3K	PART-CODE-NO	6NFF	1	1999				0
1	4O	PART-CODE-NO	6NFF	5	2	6			0
2	5I	PART-CODE-NO	6NFF	5	2999				0
2	6O	PART-CODE-NO	6NFF	5	2	10			0
3	7O	PART-CODE-NO	6NFF	5	1	1			0
1	3K	PART-NAME	10AFI	1	9999				0
1	4O	PART-NAME	10AFI	5	9	8			0
2	6O	PART-NAME	10AFI	5	9	12			0
3	7O	PART-NAME	10AFI	5	9	3			0
1	2I	PART-SIZE-AND-BRAND	3NFI	5	9	10			0
1	3K	PART-SIZE-AND-BRAND	3NFF	1	2999				0
1	4O	PART-SIZE-AND-BRAND	3NFF	5	3	7			0
2	5I	PART-SIZE-AND-BRAND	3NFF	5	3999				0
2	6O	PART-SIZE-AND-BRAND	3NFF	5	3	11			0
3	7O	PART-SIZE-AND-BRAND	3NFF	5	2	2			0
1	3K	PRICE	5NFF	1	9999				0
2	6O	PRICE	5NVF	5	9	133,	ZZ.999		0
2	6O	QTY-OUT-OF-STOCK	3NVR	1	9	9			0
2	5I	QTY-SHIPPED	3NFI	5	9999				0
2	6O	QTY-SHIPPED	3NVF	5	9	8			0
3	7O	QTY-SHIPPED	3NFI	50	9	5			0

Figure 28. Sorted list of data requirements -- second pass

```
   RESULTS OF ANALYSIS BY TIME-GRID TECHNIQUE



DATA                                          DATA
NUMBER DATA NAME                SIZE A/N USE  NUMBER DATA NAME                SIZE A/N USE
     1 COD-OR-CREDIT-CODE          1 N   FI        2 CUSTOMER-NAME             25 A   FI
     3 CUSTOMER-ORDER-NO           6 N   FI        4 CUSTR-SHIP-TO-ADDRESS     75 A   FI
     5 DATE-OF-ORDER               6 N   FI        6 DISC-QUALIFICATION-AMT     5 N   FF
     7 DISC-RATE                   2 N   VR        8 DISC-RATE-1                2 N   VF
     9 DISC-RATE-2                 2 N   VF       10 DISCOUNT-AMT               5 N   VR
    11 GROSS-DOLLARS-SHIPPED       7 N   VR       12 INVOICE-NO                 8 N   FI
    13 LINE-EXT                    6 N   VR       14 OUR-ORDER-NO               6 N   FF
    15 PART-CODE-NO                6 N   FI       16 PART-NAME                 10 A   FI
    17 PART-SIZE-AND-BRAND         3 N   FI       18 PRICE                      5 N   FF
    19 QTY-OUT-OF-STOCK            3 N   VR       20 QTY-SHIPPED                3 N   FI


DATA NUMBER                        1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19  20

CYCLE


  1 CUSTOMER-ORDER                 1   1   1   1   1   0   0   0   0   0   0   0   0   1   5   0   5   0   0   0
    (    2) 8300...  1 X D
  1 PARTS-REFERENCE-FILE           0   0   0   0   0   0   0   0   0   0   0   0   0   0   1   1   1   1   0   0
    (    3)25000...  1 X D
  1 WAREHOUSE-ORDER                0   1   1   1   0   0   0   0   0   0   0   0   0   1   5   5   5   0   0   0
    (    4) 8300...  1 X D
  2 WAREHOUSE-TICKET               0   0   0   0   0   0   0   0   0   0   0   1   0   1   5   0   5   0   0   5
    (    5)10300...  1 X D
  2 INVOICE                        1   1   1   1   1   1   1   1   1   1   0   1   5   1   5   5   5   5   1   5
    (    6)10300...  1 X D
  3 WEEKLY-SHIPMENT-REPORT         0  50   0   0   0   0   0   0   0   0   5   0  50   0   5   5   5   0   0  50
    (    7) 5000...  1 X W

SUMMARY CODES                      1  -1   1   1   1       2  -2  -2   2   2   0  -1   1  51  51  51  15   2  -1


MEANING OF SUMMARY CODES

0 - RATIO OF INPUT = RATIO OF OUTPUT, INPUT AVAILABLE AT TIME OF OUTPUT
1 - PLURAL CYCLES - FILES
2 - SYSTEM GENERATED (VARIABLE RESULT)
3 - NO INPUT BUT OUTPUT, NOT VARIABLE RESULT
4 - NO OUTPUT BUT INPUT
5 - RATIOS NOT EQUAL
6 - OUTPUT REQUIRED BEFORE INPUT IS AVAILABLE
```

Figure 29. Time-grid of data names – second pass

```
  RESULTS OF ANALYSIS BY TIME-GRID TECHNIQUE


CYCLE NO&TP NAME                    SZE CL RAT SEQFORCOMMENTS
      1   2IQUANTITY-ORDERED         3NFI   5  9  8                          0
      1   4OQUANTITY-ORDERED         3NFI   5  9  5                          0
      2   6OQUANTITY-ORDERED         3NVF   5  9  7                          0
      1   2ISHIPPING-INSTRUCTIONS  100AFI   1  9 11                          0
      1   4OSHIPPING-INSTRUCTIONS  100AFI   1  9  9                          0
      1   2ISOLD-TO-ADDRESS         75AFI   1  9  2                          0
      2   6OSOLD-TO-ADDRESS         75AFI   1  9  5                          0
      2   6OTOTAL-INVOICE-AMOUNT     8NVR   1  9 172,$$$$,$$9.99              0
```

Figure 30. Continuation of sorted list of data requirements – second pass

```
    RESULTS OF ANALYSIS BY TIME-GRID TECHNIQUE



DATA                                                    DATA
NUMBER DATA NAME                SIZE A/N USE        NUMBER DATA NAME                SIZE A/N USE
    21 QUANTITY-ORDERED            3 N   FI            22 SHIPPING-INSTRUCTIONS     100 A   FI
    23 SOLD-TO-ADDRESS            75 A   FI            24 TOTAL-INVOICE-AMOUNT        8 N   VR


DATA NUMBER                       21   22   23   24

CYCLE

  1 CUSTOMER-ORDER                 5    1    1    0
    (    2) 8300...  1 X D
  1 WAREHOUSE-ORDER                5    1    0    0
    (    4) 8300...  1 X D
  2 INVOICE                        5    0    1    1
    (    6)10300...  1 X D

SUMMARY CODES                      1    0    1    2


MEANING OF SUMMARY CODES

0 - RATIO OF INPUT = RATIO OF OUTPUT, INPUT AVAILABLE AT TIME OF OUTPUT
1 - PLURAL CYCLES - FILES
2 - SYSTEM GENERATED (VARIABLE RESULT)
3 - NO INPUT BUT OUTPUT, NOT VARIABLE RESULT
4 - NO OUTPUT BUT INPUT
5 - RATIOS NOT EQUAL
6 - OUTPUT REQUIRED BEFORE INPUT IS AVAILABLE
```

Figure 31. Continuation of time-grid – second pass

DATA NO.	DATA NAME	CODE	PAGE NO.
15	PART-CODE-NO	51	3
16	PART-NAME	51	3
17	PART-SIZE-AND-BRAND	51	3
18	PRICE	15	3

Figure 32. Summary of unresolved conditions – second pass

```
1      2 I CUSTOMER-ORDER                  8300
                  14   0   0   0   0   0   0   0
1      3 K PARTS-REFERENCE-FILE           25000
                  15  17   0   0   0   0   0   0
1      4 O WAREHOUSE-ORDER                 8300
                  14  15  17   0   0   0   0   0
2      5 I WAREHOUSE-TICKET               10300
                  14  15  17   0   0   0   0   0
2      6 O INVOICE                        10300
                  14  15  17   0   0   0   0   0
3      7 O WEEKLY-SHIPMENT-REPORT          5000
                  15  17   0   0   0   0   0   0
```

Figure 33. Time key analysis – second pass

Figure 34 shows three serial files produced in cycle 1 of the sample problem. File 1 contains data elements that are available in cycle 1 on the warehouse order (header 4) and are needed in cycle 2 to produce the invoice (header 6). The file is in sequence by data elements 14, 15, and 17 ("our order number", "part-code number", "part-size and brand"), and is the same as that of the header in which the data elements are available.

File 2 contains data supplied by the customer order (header 2) and required by the invoice (header 6). Note that the sequence of this file is "our-order-number" (data element 14) – the sequence of the customer order. File 3, arranged by "part-code number" and "part-size-and-brand" is produced from the reference file (header 3).

File 4 (Figure 35) is built in cycle 2 from the invoice (header 6) and is required by the weekly shipment report (header 7) in cycle 2. The sequence of this file is the sequence of the invoice.

Note that the files described above have not been optimized, and represent the "worst case" solution to the problem because of the number of separate files needed to make the system function.

FILES TO BE PRODUCED IN CYCLE NO. 1

OUTPUT FROM THIS CYCLE TO OTHER CYCLES

TAPE RECORD NO. 1

NO.	DATA NAME	SIZE	N/A	USE	RATIO	SEQ	FROM CYCLE	HDR	TYPE	INTO CYCLE	HDR	TYPE	KEY ELEMENTS							
14	OUR-ORDER-NO	6	N	FF	1	1	1	2	I	2	6	0	14	0	0	0	0	0	0	0
1	COD-OR-CREDIT-CODE	1	N	FI	1	9	1	2	I	2	6	0	14	0	0	0	0	0	0	0
5	DATE-OF-ORDER	6	N	FI	1	9	1	2	I	2	6	0	14	0	0	0	0	0	0	0
23	SOLD-TO-ADDRESS	75	A	FI	1	9	1	2	I	2	6	0	14	0	0	0	0	0	0	0

TAPE RECORD NO. 2

NO.	DATA NAME	SIZE	N/A	USE	RATIO	SEQ	FROM CYCLE	HDR	TYPE	INTO CYCLE	HDR	TYPE	KEY ELEMENTS							
14	OUR-ORDER-NO	6	N	FF	1	1	1	4	0	2	6	0	14	15	17	0	0	0	0	0
15	PART-CODE-NO	6	N	FI	5	2	1	4	0	2	6	0	14	15	17	0	0	0	0	0
17	PART-SIZE-AND-BRAND	3	N	FI	5	3	1	4	0	2	6	0	14	15	17	0	0	0	0	0
2	CUSTOMER-NAME	25	A	FI	1	9	1	4	0	2	6	0	14	15	17	0	0	0	0	0
3	CUSTOMER-ORDER-NO	6	N	FI	1	9	1	4	0	2	6	0	14	15	17	0	0	0	0	0
4	CUSTR-SHIP-TO-ADDRESS	75	A	FI	1	9	1	4	0	2	6	0	14	15	17	0	0	0	0	0
16	PART-NAME	10	A	FI	5	9	1	4	0	2	6	0	14	15	17	0	0	0	0	0
21	QUANTITY-ORDERED	3	N	FI	5	9	1	4	0	2	6	0	14	15	17	0	0	0	0	0

TAPE RECORD NO. 3

NO.	DATA NAME	SIZE	N/A	USE	RATIO	SEQ	FROM CYCLE	HDR	TYPE	INTO CYCLE	HDR	TYPE	KEY ELEMENTS							
15	PART-CODE-NO	6	N	FI	1	1	1	3	K	2	6	0	15	17	0	0	0	0	0	0
17	PART-SIZE-AND-BRAND	3	N	FI	1	2	1	3	K	2	6	0	15	17	0	0	0	0	0	0
18	PRICE	5	N	FF	1	9	1	3	K	2	6	0	15	17	0	0	0	0	0	0

Figure 34. Serial-file solution

FILES TO BE PRODUCED IN CYCLE NO. 2

OUTPUT FROM THIS CYCLE TO OTHER CYCLES

TAPE RECORD NO. 4

NO.	DATA NAME	SIZE	N/A	USE	RATIO	SEQ	FROM CYCLE	HDR	TYPE	INTO CYCLE	HDR	TYPE	KEY ELEMENTS							
14	OUR-ORDER-NO	6	N	FF	1	1	2	6	0	3	7	0	14	15	17	0	0	0	0	0
15	PART-CODE-NO	6	N	FI	5	2	2	6	0	3	7	0	14	15	17	0	0	0	0	0
17	PART-SIZE-AND-BRAND	3	N	FI	5	3	2	6	0	3	7	0	14	15	17	0	0	0	0	0
2	CUSTOMER-NAME	25	A	FI	1	9	2	6	0	3	7	0	14	15	17	0	0	0	0	0
13	LINE-FXT	6	N	VR	5	9	2	6	0	3	7	0	14	15	17	0	0	0	0	0
16	PART-NAME	10	A	FI	5	9	2	6	0	3	7	0	14	15	17	0	0	0	0	0
20	QTY-SHIPPED	3	N	FI	5	9	2	6	0	3	7	0	14	15	17	0	0	0	0	0

Figure 35. Serial-file solution (continued)

Report 9 (Figure 41) defines the second extreme solution – the unrestricted use of direct-access files. In this solution, files are constructed on the basis of sequence changes only.

Note that only three direct-access files have been defined by TAG. Direct-access file 1 combines serial files 1 and 4.

The direct-access solution, like the serial-file design, meets the requirements of the system but does not offer the most practical answer to the systems problem. The optimum solution will probably be a compromise between the two extremes of file design.

All working files, input and outputs for each cycle in the system, are brought together in Report 10, the job definition. Actually two groups of reports are produced, one for serial files (Figures 36-40) and one for direct-access files (Figures 42-46). Because the direct-access files may contain elements that are not required in a specified time period, the data that is required in that period is starred (see Figure 43).

ANALYSIS OF CYCLE NO. 1

INPUTS TO THIS CYCLE

2 CUSTOMER-ORDER 8300

NO.	DATA NAME	SIZE	N/A	USE	RATIO	SEQ	FORMAT	COMMENTS	KEY ELEMENTS
14	OUR-ORDER-NO	6	N	FF	1	1	5		14
1	COD-OR-CREDIT-CODE	1	N	FI	1	9	6		14
2	CUSTOMER-NAME	25	A	FI	1	9	1		14
3	CUSTOMER-ORDER-NO	6	N	FI	1	9	4		14
4	CUSTR-SHIP-TO-ADDRESS	75	A	FI	1	9	7		14
5	DATE-OF-ORDER	6	N	FI	1	9	3		14
15	PART-CODE-NO	6	N	FI	5	9	9		14
17	PART-SIZE-AND-BRAND	3	N	FI	5	9	10		14
21	QUANTITY-ORDERED	3	N	FI	5	9	8		14
22	SHIPPING-INSTRUCTIONS	100	A	FI	1	9	11		14
23	SOLD-TO-ADDRESS	75	A	FI	1	9	2		14

3 PARTS-REFERENCE-FILE 25000

NO.	DATA NAME	SIZE	N/A	USE	RATIO	SEQ	FORMAT	COMMENTS	KEY ELEMENTS
15	PART-CODE-NO	6	N	FI	1	1	999		15 17
17	PART-SIZE-AND-BRAND	3	N	FI	1	2	999		15 17
16	PART-NAME	10	A	FI	1	9	999		15 17
18	PRICE	5	N	FF	1	9	999		15 17

OUTPUT FROM THIS CYCLE TO OTHER CYCLES

NO.	DATA NAME	SIZE	N/A	USE	RATIO	SEQ	FROM CYCLE	HDR	TYPE	INTO CYCLE	HDR	TYPE	KEY ELEMENTS
14	OUR-ORDER-NO	6	N	FF	1	1	1	2	I	2	6	0	14 0 0 0 0 0 0 0
1	COD-OR-CREDIT-CODE	1	N	FI	1	9	1	2	I	2	6	0	14 0 0 0 0 0 0 0
5	DATE-OF-ORDER	6	N	FI	1	9	1	2	I	2	6	0	14 0 0 0 0 0 0 0
23	SOLD-TO-ADDRESS	75	A	FI	1	9	1	2	I	2	6	0	14 0 0 0 0 0 0 0

NO.	DATA NAME	SIZE	N/A	USE	RATIO	SEQ	FROM CYCLE	HDR	TYPE	INTO CYCLE	HDR	TYPE	KEY ELEMENTS
14	OUR-ORDER-NO	6	N	FF	1	1	1	4	0	2	6	0	14 15 17 0 0 0 0 0
15	PART-CODE-NO	6	N	FI	5	2	1	4	0	2	6	0	14 15 17 0 0 0 0 0

Figure 36. Job definition for serial files

```
 17 PART-SIZE-AND-BRAND          3 N   FI     5   3          1   4   0          2   6   0    14  15  17   0   0   0   0   0
  2 CUSTOMER-NAME               25 A   FI     1   9          1   4   0          2   6   0    14  15  17   0   0   0   0   0
  3 CUSTOMER-ORDER-NO            6 N   FI     1   9          1   4   0          2   6   0    14  15  17   0   0   0   0   0
  4 CUSTR-SHIP-TO-ADDRESS       75 A   FI     1   9          1   4   0          2   6   0    14  15  17   0   0   0   0   0
 16 PART-NAME                   10 A   FI     5   9          1   4   0          2   6   0    14  15  17   0   0   0   0   0
 21 QUANTITY-ORDERED             3 N   FI     5   9          1   4   0          2   6   0    14  15  17   0   0   0   0   0


NO.  DATA NAME                 SIZE N/A USE RATIO SEQ FROM CYCLE HDR TYPE  INTO CYCLE HDR TYPE KEY ELEMENTS


 15 PART-CODE-NO                 6 N   FI     1   1          1   3   K          2   6   0    15  17   0   0   0   0   0   0
 17 PART-SIZE-AND-BRAND          3 N   FI     1   2          1   3   K          2   6   0    15  17   0   0   0   0   0   0
 18 PRICE                        5 N   FF     1   9          1   3   K          2   6   0    15  17   0   0   0   0   0   0

          OUTPUT FROM THIS CYCLE



          4  WAREHOUSE-ORDER          8300

        NO.  DATA NAME              SIZE N/A USE RATIO SEQ FORMAT COMMENTS              KEY ELEMENTS

          14 OUR-ORDER-NO             6 N   FF     1   1      2                        14  15  17
          15 PART-CODE-NO             6 N   FI     5   2      6                        14  15  17
          17 PART-SIZE-AND-BRAND      3 N   FI     5   3      7                        14  15  17
           2 CUSTOMER-NAME           25 A   FI     1   9      3                        14  15  17
           3 CUSTOMER-ORDER-NO        6 N   FI     1   9      1                        14  15  17
           4 CUSTR-SHIP-TO-ADDRESS   75 A   FI     1   9      4                        14  15  17
          16 PART-NAME               10 A   FI     5   9      8                        14  15  17
          21 QUANTITY-ORDERED         3 N   FI     5   9      5                        14  15  17
          22 SHIPPING-INSTRUCTIONS  100 A   FI     1   9      9                        14  15  17
```

Figure 37. Job definition for serial files (continued)

```
          ANALYSIS OF CYCLE NO.  2

            INPUTS TO THIS CYCLE



          5  WAREHOUSE-TICKET         10300

        NO.  DATA NAME              SIZE N/A USE RATIO SEQ FORMAT COMMENTS              KEY ELEMENTS

          14 OUR-ORDER-NO             6 N   FF     1   1    999                        14  15  17
          15 PART-CODE-NO             6 N   FI     5   2    999                        14  15  17
          17 PART-SIZE-AND-BRAND      3 N   FI     5   3    999                        14  15  17
          12 INVOICE-NO               8 N   FI     1   9    999                        14  15  17
          20 QTY-SHIPPED              3 N   FI     5   9    999                        14  15  17


            INPUT TO THIS CYCLE FROM OTHER CYCLES

NO.  DATA NAME                 SIZE N/A USE RATIO SEQ FROM CYCLE HDR TYPE  INTO CYCLE HDR TYPE KEY ELEMENTS


 14 OUR-ORDER-NO                 6 N   FF     1   1          1   2   I          2   6   0    14   0   0   0   0   0   0   0
  1 COD-OR-CREDIT-CODE           1 N   FI     1   9          1   2   I          2   6   0    14   0   0   0   0   0   0   0
  5 DATE-OF-ORDER                6 N   FI     1   9          1   2   I          2   6   0    14   0   0   0   0   0   0   0
 23 SOLD-TO-ADDRESS             75 A   FI     1   9          1   2   I          2   6   0    14   0   0   0   0   0   0   0


NO.  DATA NAME                 SIZE N/A USE RATIO SEQ FROM CYCLE HDR TYPE  INTO CYCLE HDR TYPE KEY ELEMENTS


 14 OUR-ORDER-NO                 6 N   FF     1   1          1   4   0          2   6   0    14  15  17   0   0   0   0   0
 15 PART-CODE-NO                 6 N   FI     5   2          1   4   0          2   6   0    14  15  17   0   0   0   0   0
 17 PART-SIZE-AND-BRAND          3 N   FI     5   3          1   4   0          2   6   0    14  15  17   0   0   0   0   0
  2 CUSTOMER-NAME               25 A   FI     1   9          1   4   0          2   6   0    14  15  17   0   0   0   0   0
  3 CUSTOMER-ORDER-NO            6 N   FI     1   9          1   4   0          2   6   0    14  15  17   0   0   0   0   0
  4 CUSTR-SHIP-TO-ADDRESS       75 A   FI     1   9          1   4   0          2   6   0    14  15  17   0   0   0   0   0
 16 PART-NAME                   10 A   FI     5   9          1   4   0          2   6   0    14  15  17   0   0   0   0   0
 21 QUANTITY-ORDERED             3 N   FI     5   9          1   4   0          2   6   0    14  15  17   0   0   0   0   0


NO.  DATA NAME                 SIZE N/A USE RATIO SEQ FROM CYCLE HDR TYPE  INTO CYCLE HDR TYPE KEY ELEMENTS


 15 PART-CODE-NO                 6 N   FI     1   1          1   3   K          2   6   0    15  17   0   0   0   0   0   0
 17 PART-SIZE-AND-BRAND          3 N   FI     1   2          1   3   K          2   6   0    15  17   0   0   0   0   0   0
 18 PRICE                        5 N   FF     1   9          1   3   K          2   6   0    15  17   0   0   0   0   0   0


            OUTPUT FROM THIS CYCLE TO OTHER CYCLES
```

Figure 38. Job definition for serial files (continued)

```
NO.  DATA NAME              SIZE N/A USE RATIO SEQ FROM CYCLE HDR TYPE  INTO CYCLE HDR TYPE KEY ELEMENTS

 14 OUR-ORDER-NO             6 N   FF     1   1        2   6   0        3   7   0    14 15 17  0  0  0  0  0
 15 PART-CODE-NO             6 N   FI     5   2        2   6   0        3   7   0    14 15 17  0  0  0  0  0
 17 PART-SIZE-AND-BRAND      3 N   FI     5   3        2   6   0        3   7   0    14 15 17  0  0  0  0  0
  2 CUSTOMER-NAME           25 A   FI     1   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0
 13 LINE-EXT                 6 N   VR     5   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0
 16 PART-NAME               10 A   FI     5   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0
 20 QTY-SHIPPED              3 N   FI     5   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0

        OUTPUT FROM THIS CYCLE



        6  INVOICE                  10300

       NO.  DATA NAME              SIZE N/A USE RATIO SEQ FORMAT COMMENTS              KEY ELEMENTS

         14 OUR-ORDER-NO             6 N   FF     1   1      1                        14 15 17
         15 PART-CODE-NO             6 N   FI     5   2     10                        14 15 17
         17 PART-SIZE-AND-BRAND      3 N   FI     5   3     11                        14 15 17
          1 COD-OR-CREDIT-CODE       1 N   FI     1   9     18                        14 15 17
          2 CUSTOMER-NAME           25 A   FI     1   9      4                        14 15 17
          3 CUSTOMER-ORDER-NO        6 N   FI     1   9      2                        14 15 17
          4 CUSTR-SHIP-TO-ADDRESS   75 A   FI     1   9      6                        14 15 17
          5 DATE-OF-ORDER            6 N   FI     1   9    999                        14 15 17
          7 DISC-RATE                2 N   VR     1   9     15 2,V99                  14 15 17
         10 DISCOUNT-AMT             5 N   VR     1   9     16 2,ZZZ.99               14 15 17
         12 INVOICE-NO               8 N   FI     1   9      3                        14 15 17
         13 LINE-EXT                 6 N   VR     5   9     14 2,ZZZZ.99              14 15 17
         16 PART-NAME               10 A   FI     5   9     12                        14 15 17
         18 PRICE                    5 N   FF     5   9     13 3,ZZ.999               14 15 17
         19 QTY-OUT-OF-STOCK         3 N   VR     1   9      9                        14 15 17
         20 QTY-SHIPPED              3 N   FI     5   9      8                        14 15 17
         21 QUANTITY-ORDERED         3 N   FI     5   9      7                        14 15 17
         23 SOLD-TO-ADDRESS         75 A   FI     1   9      5                        14 15 17
         24 TOTAL-INVOICE-AMOUNT     8 N   VR     1   9     17 2,$$$$,$$9.99          14 15 17
```

Figure 39. Job definition for serial files (continued)

```
        ANALYSIS OF CYCLE NO.  3


           INPUT TO THIS CYCLE FROM OTHER CYCLES

NO.  DATA NAME              SIZE N/A USE RATIO SEQ FROM CYCLE HDR TYPE  INTO CYCLE HDR TYPE KEY ELEMENTS

 14 OUR-ORDER-NO             6 N   FF     1   1        2   6   0        3   7   0    14 15 17  0  0  0  0  0
 15 PART-CODE-NO             6 N   FI     5   2        2   6   0        3   7   0    14 15 17  0  0  0  0  0
 17 PART-SIZE-AND-BRAND      3 N   FI     5   3        2   6   0        3   7   0    14 15 17  0  0  0  0  0
  2 CUSTOMER-NAME           25 A   FI     1   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0
 13 LINE-EXT                 6 N   VR     5   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0
 16 PART-NAME               10 A   FI     5   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0
 20 QTY-SHIPPED              3 N   FI     5   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0



        7  WEEKLY-SHIPMENT-REPORT      5000

       NO.  DATA NAME              SIZE N/A USE RATIO SEQ FORMAT COMMENTS              KEY ELEMENTS

         15 PART-CODE-NO             6 N   FI     5   1      1                        15 17
         17 PART-SIZE-AND-BRAND      3 N   FI     5   2      2                        15 17
          2 CUSTOMER-NAME           25 A   FI    50   9      4                        15 17
         11 GROSS-DOLLARS-SHIPPED    7 N   VR     5   9      7 2,Z,ZZZ.99             15 17
         13 LINE-EXT                 6 N   VR    50   9      6 2,ZZZZ.99              15 17
         16 PART-NAME               10 A   FI     5   9      3                        15 17
         20 QTY-SHIPPED              3 N   FI    50   9      5                        15 17
```

Figure 40. Job definition for serial files (continued)

```
DISK FILE RECORD NO.  1

NO.  DATA NAME              SIZE N/A USE RATIO SEQ FROM CYCLE HDR TYPE  INTO CYCLE HDR TYPE KEY ELEMENTS

  14 OUR-ORDER-NO             6 N   FF      1   1          1   2   I          2   6   0   14   0   0   0   0   0   0   0
   1 COD-OR-CREDIT-CODE       1 N   FI      1   9          1   2   I          2   6   0   14   0   0   0   0   0   0   0
   5 DATE-OF-ORDER            6 N   FI      1   9          1   2   I          2   6   0   14   0   0   0   0   0   0   0
  23 SOLD-TO-ADDRESS         75 A   FI      1   9          1   2   I          2   6   0   14   0   0   0   0   0   0   0

DISK FILE RECORD NO.  2

NO.  DATA NAME              SIZE N/A USE RATIO SEQ FROM CYCLE HDR TYPE  INTO CYCLE HDR TYPE KEY ELEMENTS

  14 OUR-ORDER-NO             6 N   FF      1   1          1   4   O          2   6   0   14   15  17   0   0   0   0   0
  15 PART-CODE-NO             6 N   FI      5   2          1   4   O          2   6   0   14   15  17   0   0   0   0   0
  17 PART-SIZE-AND-BRAND      3 N   FI      5   3          1   4   O          2   6   0   14   15  17   0   0   0   0   0
   2 CUSTOMER-NAME           25 A   FI      1   9          1   4   O          2   6   0   14   15  17   0   0   0   0   0
   3 CUSTOMER-ORDER-NO        6 N   FI      1   9          1   4   O          2   6   0   14   15  17   0   0   0   0   0
   4 CUSTR-SHIP-TO-ADDRESS   75 A   FI      1   9          1   4   O          2   6   0   14   15  17   0   0   0   0   0
  16 PART-NAME               10 A   FI      5   9          1   4   O          2   6   0   14   15  17   0   0   0   0   0
  21 QUANTITY-ORDERED         3 N   FI      5   9          1   4   O          2   6   0   14   15  17   0   0   0   0   0
  13 LINE-EXT                 6 N   VR      5   9          2   6   O          3   7   0   14   15  17   0   0   0   0   0
  20 QTY-SHIPPED              3 N   FI      5   9          2   6   O          3   7   0   14   15  17   0   0   0   0   0

DISK FILE RECORD NO.  3

NO.  DATA NAME              SIZE N/A USE RATIO SEQ FROM CYCLE HDR TYPE  INTO CYCLE HDR TYPE KEY ELEMENTS

  15 PART-CODE-NO             6 N   FI      1   1          1   3   K          2   6   0   15   17   0   0   0   0   0   0
  17 PART-SIZE-AND-BRAND      3 N   FI      1   2          1   3   K          2   6   0   15   17   0   0   0   0   0   0
  18 PRICE                    5 N   FF      1   9          1   3   K          2   6   0   15   17   0   0   0   0   0   0
```

Figure 41. Direct-access file solution

```
          ANALYSIS OF CYCLE NO.  1

            INPUTS TO THIS CYCLE



            2  CUSTOMER-ORDER            8300

            NO.  DATA NAME              SIZE N/A USE RATIO SEQ FORMAT COMMENTS              KEY ELEMENTS

              14 OUR-ORDER-NO             6 N   FF      1   1      5                          14
               1 COD-OR-CREDIT-CODE       1 N   FI      1   9      6                          14
               2 CUSTOMER-NAME           25 A   FI      1   9      1                          14
               3 CUSTOMER-ORDER-NO        6 N   FI      1   9      4                          14
               4 CUSTR-SHIP-TO-ADDRESS   75 A   FI      1   9      7                          14
               5 DATE-OF-ORDER            6 N   FI      1   9      3                          14
              15 PART-CODE-NO             6 N   FI      5   9      9                          14
              17 PART-SIZE-AND-BRAND      3 N   FI      5   9     10                          14
              21 QUANTITY-ORDERED         3 N   FI      5   9      8                          14
              22 SHIPPING-INSTRUCTIONS  100 A   FI      1   9     11                          14
              23 SOLD-TO-ADDRESS         75 A   FI      1   9      2                          14



            3  PARTS-REFERENCE-FILE      25000

            NO.  DATA NAME              SIZE N/A USE RATIO SEQ FORMAT COMMENTS              KEY ELEMENTS

              15 PART-CODE-NO             6 N   FI      1   1    999                          15  17
              17 PART-SIZE-AND-BRAND      3 N   FI      1   2    999                          15  17
              16 PART-NAME               10 A   FI      1   9    999                          15  17
              18 PRICE                    5 N   FF      1   9    999                          15  17


              OUTPUT FROM THIS CYCLE TO OTHER CYCLES

NO.  DATA NAME              SIZE N/A USE RATIO SEQ FROM CYCLE HDR TYPE  INTO CYCLE HDR TYPE KEY ELEMENTS

*  14 OUR-ORDER-NO             6 N   FF      1   1          1   2   I          2   6   0   14   0   0   0   0   0   0   0
*   1 COD-OR-CREDIT-CODE       1 N   FI      1   9          1   2   I          2   6   0   14   0   0   0   0   0   0   0
*   5 DATE-OF-ORDER            6 N   FI      1   9          1   2   I          2   6   0   14   0   0   0   0   0   0   0
*  23 SOLD-TO-ADDRESS         75 A   FI      1   9          1   2   I          2   6   0   14   0   0   0   0   0   0   0


NO.  DATA NAME              SIZE N/A USE RATIO SEQ FROM CYCLE HDR TYPE  INTO CYCLE HDR TYPE KEY ELEMENTS

*  14 OUR-ORDER-NO             6 N   FF      1   1          1   4   O          2   6   0   14   15  17   0   0   0   0   0
*  15 PART-CODE-NO             6 N   FI      5   2          1   4   O          2   6   0   14   15  17   0   0   0   0   0
```

Figure 42. Job definition for direct-access files

```
*  17 PART-SIZE-AND-BRAND          3 N  FI    5  3        1  4  0        2  6  0    14 15 17  0  0  0  0  0
*   2 CUSTOMER-NAME               25 A  FI    1  9        1  4  0        2  6  0    14 15 17  0  0  0  0  0
*   3 CUSTOMER-ORDER-NO            6 N  FI    1  9        1  4  0        2  6  0    14 15 17  0  0  0  0  0
*   4 CUSTR-SHIP-TO-ADDRESS       75 A  FI    1  9        1  4  0        2  6  0    14 15 17  0  0  0  0  0
    13 LINE-EXT                    6 N  VR    5  9        1  4  0        2  6  0    14 15 17  0  0  0  0  0
*  16 PART-NAME                   10 A  FI    5  9        1  4  0        2  6  0    14 15 17  0  0  0  0  0
    20 QTY-SHIPPED                 3 N  FI    5  9        1  4  0        2  6  0    14 15 17  0  0  0  0  0
*  21 QUANTITY-ORDERED            3 N  FI    5  9        1  4  0        2  6  0    14 15 17  0  0  0  0  0


NO.  DATA NAME                SIZE N/A USE RATIO SEQ FROM CYCLE HDR TYPE  INTO CYCLE HDR TYPE KEY ELEMENTS

*  15 PART-CODE-NO                6 N  FI    1  1        1  3  K        2  6  0    15 17  0  0  0  0  0  0
*  17 PART-SIZE-AND-BRAND         3 N  FI    1  2        1  3  K        2  6  0    15 17  0  0  0  0  0  0
*  18 PRICE                       5 N  FF    1  9        1  3  K        2  6  0    15 17  0  0  0  0  0  0

          OUTPUT FROM THIS CYCLE



          4  WAREHOUSE-ORDER          8300

          NO.  DATA NAME             SIZE N/A USE RATIO SEQ FORMAT COMMENTS          KEY ELEMENTS

            14 OUR-ORDER-NO             6 N  FF    1  1     2                       14 15 17
            15 PART-CODE-NO             6 N  FI    5  2     6                       14 15 17
            17 PART-SIZE-AND-BRAND      3 N  FI    5  3     7                       14 15 17
             2 CUSTOMER-NAME           25 A  FI    1  9     3                       14 15 17
             3 CUSTOMER-ORDER-NO        6 N  FI    1  9     1                       14 15 17
             4 CUSTR-SHIP-TO-ADDRESS   75 A  FI    1  9     4                       14 15 17
            16 PART-NAME               10 A  FI    5  9     8                       14 15 17
            21 QUANTITY-ORDERED         3 N  FI    5  9     5                       14 15 17
            22 SHIPPING-INSTRUCTIONS  100 A  FI    1  9     9                       14 15 17
```

Figure 43. Job definition for direct-access files (continued)

```
          ANALYSIS OF CYCLE NO.  2

            INPUTS TO THIS CYCLE



            5  WAREHOUSE-TICKET         10300

            NO.  DATA NAME             SIZE N/A USE RATIO SEQ FORMAT COMMENTS          KEY ELEMENTS

              14 OUR-ORDER-NO             6 N  FF    1  1   999                       14 15 17
              15 PART-CODE-NO             6 N  FI    5  2   999                       14 15 17
              17 PART-SIZE-AND-BRAND      3 N  FI    5  3   999                       14 15 17
              12 INVOICE-NO               8 N  FI    1  9   999                       14 15 17
              20 QTY-SHIPPED              3 N  FI    5  9   999                       14 15 17


              INPUT TO THIS CYCLE FROM OTHER CYCLES

NO.  DATA NAME                SIZE N/A USE RATIO SEQ FROM CYCLE HDR TYPE  INTO CYCLE HDR TYPE KEY ELEMENTS

*  14 OUR-ORDER-NO                6 N  FF    1  1        1  2  I        2  6  0    14  0  0  0  0  0  0  0
*   1 COD-OR-CREDIT-CODE          1 N  FI    1  9        1  2  I        2  6  0    14  0  0  0  0  0  0  0
*   5 DATE-OF-ORDER               6 N  FI    1  9        1  2  I        2  6  0    14  0  0  0  0  0  0  0
*  23 SOLD-TO-ADDRESS            75 A  FI    1  9        1  2  I        2  6  0    14  0  0  0  0  0  0  0


NO.  DATA NAME                SIZE N/A USE RATIO SEQ FROM CYCLE HDR TYPE  INTO CYCLE HDR TYPE KEY ELEMENTS

*  14 OUR-ORDER-NO                6 N  FF    1  1        1  4  0        2  6  0    14 15 17  0  0  0  0  0
*  15 PART-CODE-NO                6 N  FI    5  2        1  4  0        2  6  0    14 15 17  0  0  0  0  0
*  17 PART-SIZE-AND-BRAND         3 N  FI    5  3        1  4  0        2  6  0    14 15 17  0  0  0  0  0
*   2 CUSTOMER-NAME              25 A  FI    1  9        1  4  0        2  6  0    14 15 17  0  0  0  0  0
*   3 CUSTOMER-ORDER-NO           6 N  FI    1  9        1  4  0        2  6  0    14 15 17  0  0  0  0  0
*   4 CUSTR-SHIP-TO-ADDRESS      75 A  FI    1  9        1  4  0        2  6  0    14 15 17  0  0  0  0  0
    13 LINE-EXT                   6 N  VR    5  9        1  4  0        2  6  0    14 15 17  0  0  0  0  0
*  16 PART-NAME                  10 A  FI    5  9        1  4  0        2  6  0    14 15 17  0  0  0  0  0
    20 QTY-SHIPPED                3 N  FI    5  9        1  4  0        2  6  0    14 15 17  0  0  0  0  0
*  21 QUANTITY-ORDERED           3 N  FI    5  9        1  4  0        2  6  0    14 15 17  0  0  0  0  0


NO.  DATA NAME                SIZE N/A USE RATIO SEQ FROM CYCLE HDR TYPE  INTO CYCLE HDR TYPE KEY ELEMENTS

*  15 PART-CODE-NO                6 N  FI    1  1        1  3  K        2  6  0    15 17  0  0  0  0  0  0
*  17 PART-SIZE-AND-BRAND         3 N  FI    1  2        1  3  K        2  6  0    15 17  0  0  0  0  0  0
*  18 PRICE                       5 N  FF    1  9        1  3  K        2  6  0    15 17  0  0  0  0  0  0


            OUTPUT FROM THIS CYCLE TO OTHER CYCLES
```

Figure 44. Job definition for direct-access files (continued)

```
NO.  DATA NAME                SIZE N/A USE RATIO SEQ FROM CYCLE HDR TYPE  INTO CYCLE HDR TYPE KEY ELEMENTS

*  14 OUR-ORDER-NO              6 N   FF      1   1        2   6   0        3   7   0    14 15 17  0  0  0  0  0
*  15 PART-CODE-NO              6 N   FI      5   2        2   6   0        3   7   0    14 15 17  0  0  0  0  0
*  17 PART-SIZE-AND-BRAND       3 N   FI      5   3        2   6   0        3   7   0    14 15 17  0  0  0  0  0
*   2 CUSTOMER-NAME            25 A   FI      1   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0
    3 CUSTOMER-ORDER-NO         6 N   FI      1   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0
    4 CUSTR-SHIP-TO-ADDRESS    75 A   FI      1   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0
*  13 LINE-EXT                  6 N   VR      5   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0
*  16 PART-NAME                10 A   FI      5   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0
*  20 QTY-SHIPPED               3 N   FI      5   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0
   21 QUANTITY-ORDERED          3 N   FI      5   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0

          OUTPUT FROM THIS CYCLE


          6  INVOICE                    10300

          NO.  DATA NAME                SIZE N/A USE RATIO SEQ FORMAT COMMENTS              KEY ELEMENTS

            14 OUR-ORDER-NO              6 N   FF      1   1      1                         14 15 17
            15 PART-CODE-NO              6 N   FI      5   2     10                         14 15 17
            17 PART-SIZE-AND-BRAND       3 N   FI      5   3     11                         14 15 17
             1 COD-OR-CREDIT-CODE        1 N   FI      1   9     18                         14 15 17
             2 CUSTOMER-NAME            25 A   FI      1   9      4                         14 15 17
             3 CUSTOMER-ORDER-NO         6 N   FI      1   9      2                         14 15 17
             4 CUSTR-SHIP-TO-ADDRESS    75 A   FI      1   9      6                         14 15 17
             5 DATE-OF-ORDER             6 N   FI      1   9    999                         14 15 17
             7 DISC-RATE                 2 N   VR      1   9     15 2,V99                   14 15 17
            10 DISCOUNT-AMT              5 N   VR      1   9     16 2,ZZZ.99                14 15 17
            12 INVOICE-NO                8 N   FI      1   9      3                         14 15 17
            13 LINE-EXT                  6 N   VR      5   9     14 2,ZZZZ.99               14 15 17
            16 PART-NAME                10 A   FI      5   9     12                         14 15 17
            18 PRICE                     5 N   FF      5   9     13 3,ZZ.999                14 15 17
            19 QTY-OUT-OF-STOCK          3 N   VR      1   9      9                         14 15 17
            20 QTY-SHIPPED               3 N   FI      5   9      8                         14 15 17
            21 QUANTITY-ORDERED          3 N   FI      5   9      7                         14 15 17
            23 SOLD-TO-ADDRESS          75 A   FI      1   9      5                         14 15 17
            24 TOTAL-INVOICE-AMOUNT      8 N   VR      1   9     17 2,$$$$,$$9.99           14 15 17
```

Figure 45. Job definition for direct-access files (continued)

```
          ANALYSIS OF CYCLE NO.  3


               INPUT TO THIS CYCLE FROM OTHER CYCLES

NO.  DATA NAME                SIZE N/A USE RATIO SEQ FROM CYCLE HDR TYPE  INTO CYCLE HDR TYPE KEY ELEMENTS

*  14 OUR-ORDER-NO              6 N   FF      1   1        2   6   0        3   7   0    14 15 17  0  0  0  0  0
*  15 PART-CODE-NO              6 N   FI      5   2        2   6   0        3   7   0    14 15 17  0  0  0  0  0
*  17 PART-SIZE-AND-BRAND       3 N   FI      5   3        2   6   0        3   7   0    14 15 17  0  0  0  0  0
*   2 CUSTOMER-NAME            25 A   FI      1   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0
    3 CUSTOMER-ORDER-NO         6 N   FI      1   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0
    4 CUSTR-SHIP-TO-ADDRESS    75 A   FI      1   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0
*  13 LINE-EXT                  6 N   VR      5   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0
*  16 PART-NAME                10 A   FI      5   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0
*  20 QTY-SHIPPED               3 N   FI      5   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0
   21 QUANTITY-ORDERED          3 N   FI      5   9        2   6   0        3   7   0    14 15 17  0  0  0  0  0


          7  WEEKLY-SHIPMENT-REPORT      5000

          NO.  DATA NAME                SIZE N/A USE RATIO SEQ FORMAT COMMENTS              KEY ELEMENTS

            15 PART-CODE-NO              6 N   FI      5   1      1                         15 17
            17 PART-SIZE-AND-BRAND       3 N   FI      5   2      2                         15 17
             2 CUSTOMER-NAME            25 A   FI     50   9      4                         15 17
            11 GROSS-DOLLARS-SHIPPED     7 N   VR      5   9      7 2,Z,ZZZ.99              15 17
            13 LINE-EXT                  6 N   VR     50   9      6 2,ZZZZ.99               15 17
            16 PART-NAME                10 A   FI      5   9      3                         15 17
            20 QTY-SHIPPED               3 N   FI     50   9      5                         15 17
```

Figure 46. Job definition for direct-access files (continued)

Y20-0358-0

Printed in U.S.A. Y20-0358-0

IBM

International Business Machines Corporation
Data Processing Division
112 East Post Road, White Plains, N. Y. 10601
(USA Only)

IBM World Trade Corporation
821 United Nations Plaza, New York, New York 10017
(International)

Approved For Release 2008/06/05 : CIA-RDP73T00325R000100040003-6

CURRENT

PROJECT CATEGORY / SUB-CATEGORY / REQUESTER	REMAINING FROM PREVIOUS PERIOD								RECEIVED DURING PERIOD (Footnote "Base" Studies)				ACCOMPLISHED DURING PERIOD								REMAINING END OF CURRENT PERIOD								ESTIMATED INPUT				WORKLOAD REMAINING ESTIMATED			
	ALL OTHER PROJECTS				"BASE" STUDIES ONLY				ALL OTHER PROJECTS				ALL OTHER PROJECTS				"BASE" STUDIES ONLY				ALL OTHER PROJECTS				"BASE" STUDIES ONLY											
	NO PROS	MAN-HOURS REMAINING PI	SPPT	TOT	NO PROS	MAN-HOURS (REMAINING) PI	SPPT	TOT	NO PROS	ESTIMATED MAN-HOURS PI	SPPT	TOT	NO PROS COMPLETED	MAN-HOURS EXPENDED ON ALL OTHER PI	SPPT	TOT	NO PROS COMPLETED	MAN-HOURS EXPENDED ON BASE STUDIES PI	SPPT	TOT	NO PROS	MAN-HOURS REMAINING PI	SPPT	TOT	NO PROS	MAN-HOURS REMAINING PI	SPPT	TOT	NO PROS	ESTIMATED MAN-HOURS PI	SPPT	TOT	NO PROS	ESTIMATED MAN-HOURS PI	SPPT	TOT
KH-4 MIS CAT NA																																		
MIS CAT NB																																		
MIS CAT DE																																		
TOTAL KH-4																																		
TOTAL MISSION																																		
NAT'L DETAIL-STANDING REQ.																																		
MISSILES (MIS CAT BA)																																		
GMAIC	2	100	300	400	1	500	1000	1500	1	100	500	600	1	100	200	300	—	400	500	900	2	100	600	700	1	100	500	600	—	—	—	—	3	200	1100	1300
CIA	1	50	150	200	1	500	1000	1500	1	100	500	600	1	100	200	300	—	400	500	900	1	50	450	500	1	100	500	600	—	—	—	—	2	150	950	1100
DEFENSE	—	—	—	—																														
TOTAL	3	150	450	600	2	1000	2000	3000	2	200	100	1200	2	200	400	600	—	800	1000	1800	3	150	1050	1200	3	200	1000	1200	—	—	—	—	5	350	2050	2400
BW/CW (MIS CAT XX) SAEIC																																		
TOTAL	2	200	200	400	3	500	500	1000	1	100	200	300	1	200	200	400	—	70	130	200	2	100	200	300	3	430	370	800	—	—	—	—	5	530	570	1100
TOTAL NAT'L DETAIL STANDING	5	350	650	1000	5	1500	2500	4000	3	300	300	1500	3	400	600	1000	—	870	1130	2000	5	250	1250	1500	5	630	1370	2000	—	—	—	—	10	880	2620	3500
NAT'L DETAIL-AD HOC																																		
IAD DETAIL-STANDING REQ.																																		
IAD DETAIL-AD HOC REQ																																		
NATIONAL SERVICES																																		
MIS CAT CA																																		
TOTAL NAT'L SERVICES																																		
LEAVE - NPIC																																		
LEAVE - IAD																																		
TOTAL NPIC & IAD																																		